Tranquility® Modular (TSM) Vertical Stack Series

Commercial Vertical Stack Water-Source Heat Pumps

Installation, Operation & Maintenance

97B0111N01
Rev.: 26 August, 2015

ClimateMaster®
Water-Source Heat Pump Systems

Table of Contents

General Information	3
TSM Model Nomenclature - Cabinet	4
Cabinet Slot Dimensions and Riser Arrangements	5
TSM Cabinet Configurations	6
TSM Model Nomenclature - Chassis	7
Accessory Nomenclature	8
Pre-Installation Information	9
Riser & Cabinet Installation	10
Cabinet Installation	13
Water-Loop Heat Pump Applications	20
Ground-Loop Heat Pump Applications	21
Ground-Water Heat Pump Applications	22
Water Quality Standards	23
Electrical Wiring - Line Voltage	24
Blower Performance Data	25
Electrical Wiring - Low Voltage	27
Thermostat Installation	28
Chassis Pre-Installation	29
Hose Kit & Chassis Installation	30
Start-Up Preparation	33
TSM Series Wiring Diagram Matrix	34
Connections to DDC Options	35
Typical Wiring Diagrams	36-39
CXM Control	40
DXM2 Control	41
Safety Features - CXM/DXM2 Controls	43
Unit Commissioning and Operating Conditions	45
Unit and System Checkout	46
Unit Start-Up Procedures	47
Unit Operating Pressures and Temperatures	48
Coax Water Pressure Drop	51
Start-Up Log Sheet	52
Preventive Maintenance	53
Functional Troubleshooting	54
Performance Troubleshooting	55
Harness Part Numbers	56-58
Troubleshooting Form	59
Warranty	60
Revision History	64

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General Information - Inspection

Safety
Warnings, cautions, and notices appear throughout this manual. Read these items carefully before attempting any installation, service, or troubleshooting of the equipment.

DANGER: Indicates an immediate hazardous situation, which if not avoided will result in death or serious injury. DANGER labels on unit access panels must be observed.

WARNING: Indicates a potentially hazardous situation, which if not avoided could result in death or serious injury.

⚠ WARNING! ⚠

WARNING! Verify refrigerant type before proceeding. Units are shipped with R-407c and HFC-410A (EarthPure®) refrigerants. The unit label will indicate which refrigerant is provided. The EarthPure® Application and Service Manual should be read and understood before attempting to service refrigerant circuits with R-407c or HFC-410A.

⚠ WARNING! ⚠

WARNING! To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must be serviced only by technicians who meet local, state, and federal proficiency requirements.

⚠ WARNING! ⚠

WARNING! The installation of water-source heat pumps and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

Dimensions are inches (mm).

Inspection - Upon receipt of the equipment, carefully check the shipment against the bill of lading. See figure 1 for components. Make sure all units have been received. Inspect the packaging of each unit, and inspect each unit for damage. Ensure that the carrier makes proper notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. If not filed within 15 days, the freight company can deny the claim without recourse. Note: It is the responsibility of the purchaser to file all necessary claims with the carrier. Notify your equipment supplier of all damage within fifteen (15) days of shipment.

CAUTION: Indicates a potentially hazardous situation or an unsafe practice, which if not avoided could result in minor or moderate injury or product or property damage.

NOTICE: Notification of installation, operation, or maintenance information, which is important, but which is not hazard-related.

⚠ WARNING! ⚠

WARNING! All refrigerant discharged from this unit must be recovered WITHOUT EXCEPTION. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If a compressor is removed from this unit, refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, refrigerant lines of the compressor must be sealed after it is removed.

⚠ CAUTION! ⚠

CAUTION! To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. The mechanical components and filters will quickly become clogged with construction dirt and debris, which may cause system damage.

⚠ WARNING! ⚠

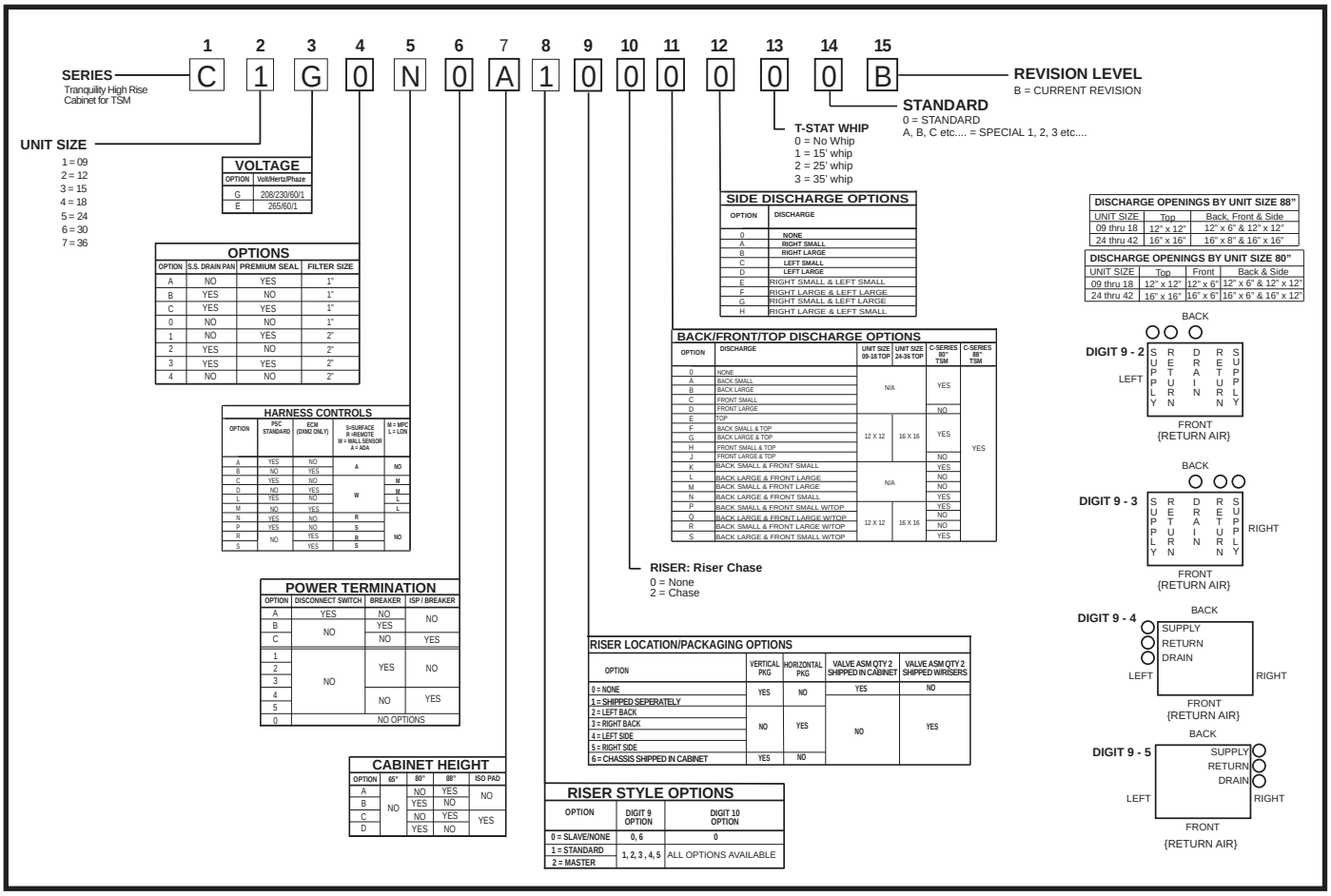
WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

TSM Vertical Stack

Rev.:08/26/15

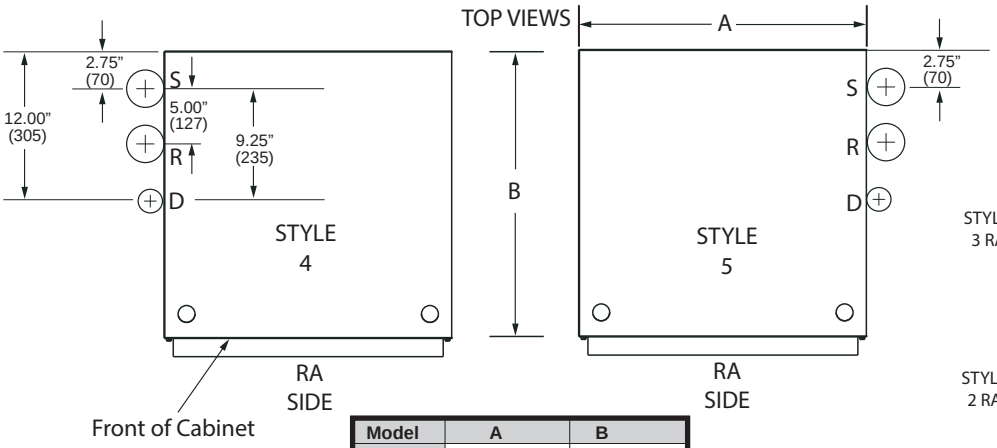
TSM Model Nomenclature - Cabinet

Cabinet

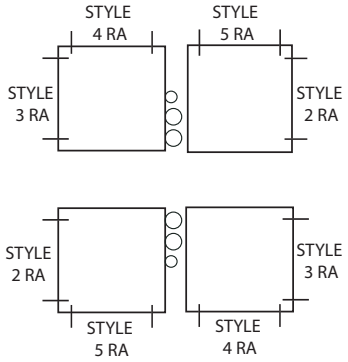

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
C 1 G 0 N 0 A 1 0 0 0 0 0 0 B
SERIES
Tranquility High Rise Cabinet for TSM
UNIT SIZE
1 = 09
2 = 12
3 = 15
4 = 18
5 = 24
6 = 30
7 = 36
REVISION LEVEL
B = CURRENT REVISION
STANDARD
0 = STANDARD
A, B, C etc.... = SPECIAL 1, 2, 3 etc....
T-STAT WHIP
0 = No Whip
1 = 15' whip
2 = 25' whip
3 = 35' whip
RISER: Riser Chase
0 = None
2 = Chase
VOLTAGE
OPTION | Volt/Hertz/Phaze
G | 208/230/60/1
E | 265/60/1
OPTIONS
OPTION | S.S. DRAIN PAN | PREMIUM SEAL | FILTER SIZE
A | NO | YES | 1"
B | YES | NO | 1"
C | YES | YES | 1"
0 | NO | NO | 1"
1 | NO | YES | 2"
2 | YES | NO | 2"
3 | YES | YES | 2"
4 | NO | NO | 2"
HARNESS CONTROLS
OPTION | PSC STANDARD | ECM (DIM2 ONLY) | S=SURFACE R =REMOTE W = WALL SENSOR A = ADA | M = MPC L = LON
A | YES | NO | A | NO
B | NO | YES | | M
C | YES | NO | W | M
D | NO | YES | | L
L | YES | NO | | L
M | NO | YES | | L
N | YES | NO | R | NO
P | YES | NO | S |
R | NO | YES | R |
S | | YES | S |
POWER TERMINATION
OPTION | DISCONNECT SWITCH | BREAKER | ISP / BREAKER
A | YES | NO | NO
B | NO | YES |
C | | NO | YES
1 | NO | YES | NO
2 | | |
3 | | |
4 | | NO | YES
5 | | |
0 | NO OPTIONS
CABINET HEIGHT
OPTION | 65" | 80" | 88" | ISO PAD
A | NO | NO | YES | NO
B | | YES | NO |
C | | NO | YES | YES
D | | YES | NO |
SIDE DISCHARGE OPTIONS
OPTION | DISCHARGE
0 | NONE
A | RIGHT SMALL
B | RIGHT LARGE
C | LEFT SMALL
D | LEFT LARGE
E | RIGHT SMALL & LEFT SMALL
F | RIGHT LARGE & LEFT LARGE
G | RIGHT SMALL & LEFT LARGE
H | RIGHT LARGE & LEFT SMALL
BACK/FRONT/TOP DISCHARGE OPTIONS
OPTION | DISCHARGE | UNIT SIZE 09-18 TOP | UNIT SIZE 24-36 TOP | C-SERIES 80" TSM | C-SERIES 88" TSM
0 | NONE | N/A | | YES | YES
A | BACK SMALL | | | |
B | BACK LARGE | | | |
C | FRONT SMALL | | | NO |
D | FRONT LARGE | | | |
E | TOP | 12 X 12 | 16 X 16 | YES |
F | BACK SMALL & TOP | | | |
G | BACK LARGE & TOP | | | |
H | FRONT SMALL & TOP | | | NO |
J | FRONT LARGE & TOP | N/A | | YES |
K | BACK SMALL & FRONT SMALL | | | NO |
L | BACK LARGE & FRONT LARGE | | | NO |
M | BACK SMALL & FRONT LARGE | | | YES |
N | BACK LARGE & FRONT SMALL | | | NO |
P | BACK SMALL & FRONT SMALL W/TOP | 12 X 12 | 16 X 16 | YES |
Q | BACK LARGE & FRONT LARGE W/TOP | | | NO |
R | BACK SMALL & FRONT LARGE W/TOP | | | NO |
S | BACK LARGE & FRONT SMALL W/TOP | | | YES |
RISER LOCATION/PACKAGING OPTIONS
OPTION | VERTICAL PKG | HORIZONTAL PKG | VALVE ASM QTY 2 SHIPPED IN CABINET | VALVE ASM QTY 2 SHIPPED W/RISERS
0 = NONE | YES | NO | YES | NO
1 = SHIPPED SEPERATELY | NO | YES | NO | YES
2 = LEFT BACK
3 = RIGHT BACK
4 = LEFT SIDE
5 = RIGHT SIDE
6 = CHASSIS SHIPPED IN CABINET | YES | NO
RISER STYLE OPTIONS
OPTION | DIGIT 9 OPTION | DIGIT 10 OPTION
0 = SLAVE/NONE | 0, 6 | 0
1 = STANDARD | 1, 2, 3 , 4, 5 | ALL OPTIONS AVAILABLE
2 = MASTER
DISCHARGE OPENINGS BY UNIT SIZE 88"
UNIT SIZE | Top | Back, Front & Side
09 thru 18 | 12" x 12" | 12" x 6" & 12" x 12"
24 thru 42 | 16" x 16" | 16" x 8" & 16" x 16"
DISCHARGE OPENINGS BY UNIT SIZE 80"
UNIT SIZE | Top | Front | Back & Side
09 thru 18 | 12" x 12" | 12" x 6" | 12" x 6" & 12" x 12"
24 thru 42 | 16" x 16" | 16" x 6" | 16" x 6" & 16" x 12"
DIGIT 9 - 2
BACK
LEFT
SUPPLY RETURN
RETURN AIR
FRONT
{RETURN AIR}
DIGIT 9 - 3
BACK
SUPPLY RETURN
RETURN AIR
RIGHT
FRONT
{RETURN AIR}
DIGIT 9 - 4
BACK
SUPPLY
RETURN
DRAIN
LEFT
RIGHT
FRONT
{RETURN AIR}
DIGIT 9 - 5
BACK
SUPPLY
RETURN
DRAIN
LEFT
RIGHT
FRONT
{RETURN AIR}

Cabinet Slot Dimensions and Riser Arrangements

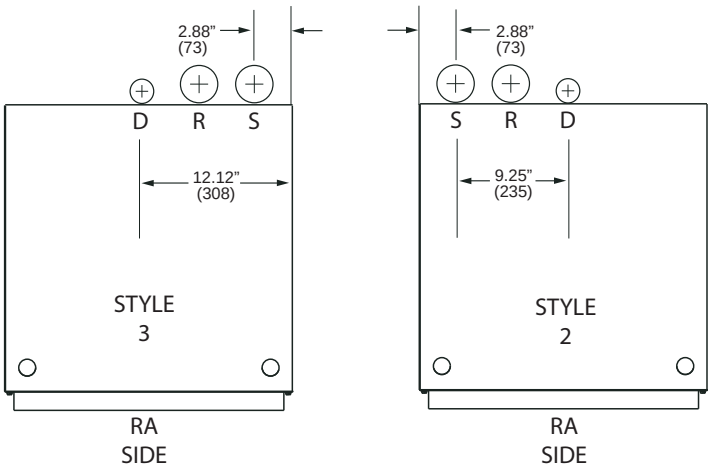
Cabinet Model Digit 9

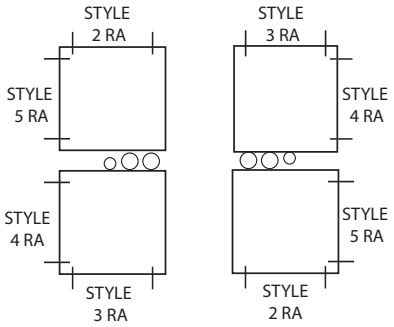


Model	A	B
09-18	19.25 [489]	19 [483]
24-36	24.25 [616]	24 [610]

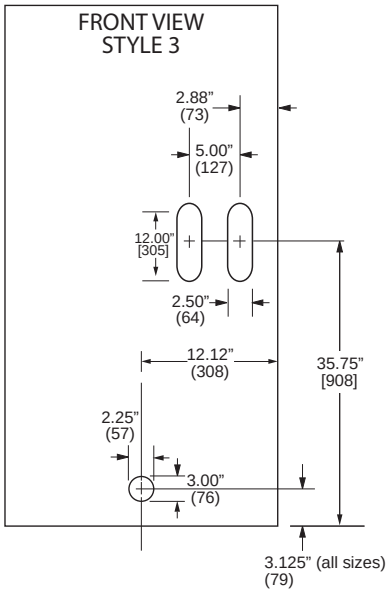


Note 8





Note 8



⚠ NOTICE! ⚠

NOTICE! Not all styles will stack above or adjacent to each other. (See Note 8).

Notes:

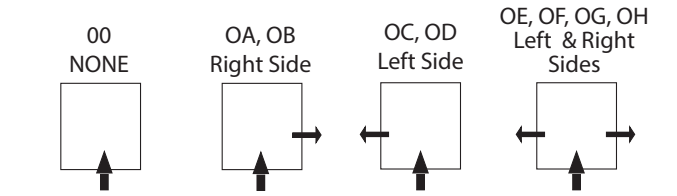
1. Dimensions are inches [mm].
2. Style refers to cabinet model digit 9 - riser location.
3. **Return air side is the front of the cabinet.**
4. Supply riser is closest to corner.
5. Drain is not centered on C1–C4 cabinets.
6. Slots allow for riser stack expansion and contraction.
7. Riser stub out is 39.75" (1100) from bottom cabinet and is not centered in slot.
8. From floor to floor on one riser stack you can only have; all same style, styles 2 and 5; or styles 3 and 4. For master/slave units you can only have styles 3 or 4 adjacent to 2 or 5.

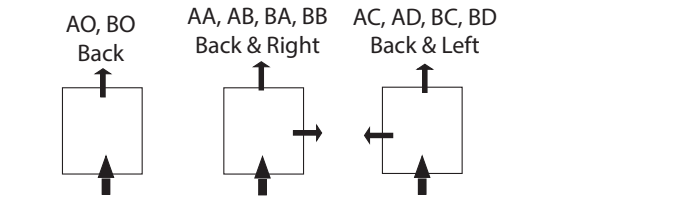
TSM Vertical Stack

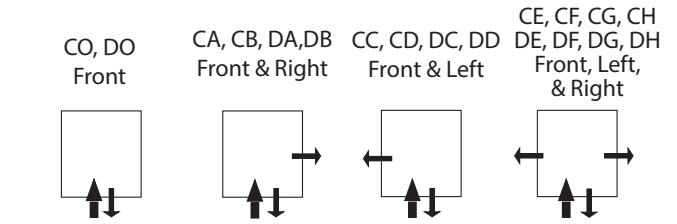
Rev.:08/26/15

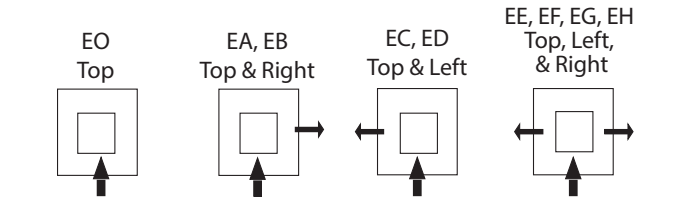
TSM Cabinet Configurations

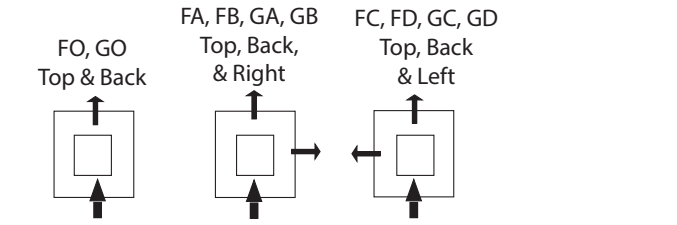
Cabinet Model Digits 11 and 12 Describe Air Flow Configuration

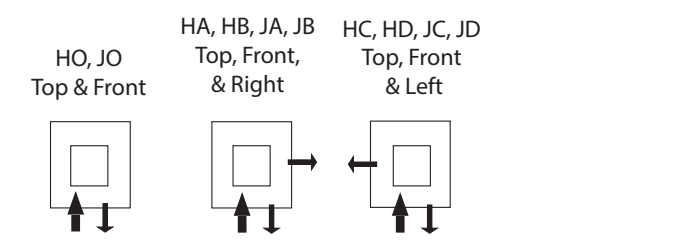


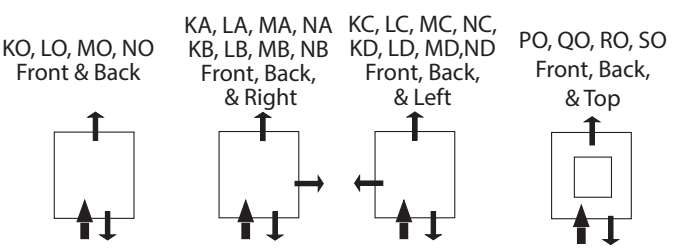












Notes:

1. **Front is return air side and control box location.**
2. **Risers can be on any side without return or supply air openings.**
3. **All sides and top have KO's.**
4. **80" Cabinet cannot have front large discharge.**

LEGEND

= RETURN AIR (AIR ENTERING CABINET)

= SUPPLY AIR (AIR LEAVING CABINET)

BACK/FRONT/TOP DISCHARGE OPTIONS – DIGIT 11

OPTION	DISCHARGE	UNIT SIZE 09-18 TOP	UNIT SIZE 24-36 TOP	C-SERIES 80" TSM	C-SERIES 88" TSM
0	NONE	N/A		YES	YES
A	BACK SMALL				
B	BACK LARGE				
C	FRONT SMALL				
D	FRONT LARGE			NO	
E	TOP	12 X 12	16 X 16	YES	
F	BACK SMALL & TOP				
G	BACK LARGE & TOP				
H	FRONT SMALL & TOP				
J	FRONT LARGE & TOP			NO	
K	BACK SMALL & FRONT SMALL	N/A		YES	
L	BACK LARGE & FRONT LARGE			NO	
M	BACK SMALL & FRONT LARGE			NO	
N	BACK LARGE & FRONT SMALL			YES	
P	BACK SMALL & FRONT SMALL W/TOP	12 X 12	16 X 16	YES	
Q	BACK LARGE & FRONT LARGE W/TOP			NO	
R	BACK SMALL & FRONT LARGE W/TOP			NO	
S	BACK LARGE & FRONT SMALL W/TOP			YES	

SIDE DISCHARGE OPTIONS – DIGIT 12

OPTION	DISCHARGE
0	**NONE**
A	**RIGHT SMALL**
B	**RIGHT LARGE**
C	**LEFT SMALL**
D	**LEFT LARGE**
E	RIGHT SMALL & LEFT SMALL
F	RIGHT LARGE & LEFT LARGE
G	RIGHT SMALL & LEFT LARGE
H	RIGHT LARGE & LEFT SMALL

TSM Model Nomenclature - Chassis

Chassis

1 2 3	4 5	6	7	8	9	10	11	12	13	14	15
T S M	09	G	S	A	S	S	C	S	S	S	B

Series
TSM = TRANQUILITY® HIGH RISE CHASSIS

Unit Size
09
12
15
18
24
30
36

Voltage
E = 265/60/1
G = 208/230/60/1

Revision Level
B = Current Revision Level

Standard
S = Standard
A = Special #1
B = Special #2
Etc.....

Future Use
S = Standard

Shipping
6 = Chassis Will Ship In Cabinet (Risers Not Attached)
S = Standard

Heat Exchanger Options

Position 11	Tin Plated Air Coil		Non-Coated Air Coil	
	Copper	Cupro-nickel	Copper	Cupro-nickel
Standard Tubing	C	N	L	M
Insulated Tubing (Extended Range)	D	E	F	G

Chassis Options

OPTION	S.S. Drain Pan	Ultraquiet	For Communicating T-Stat	RIB RELAY
A	YES	NO	NO	NO
B	NO	YES		
C	YES	YES		
S	NO	NO		
D	YES	NO	YES	
E	NO	YES		
F	YES	YES		
G	NO	NO		
H	YES	NO	NO	YES
K	NO	YES		
L	YES	YES		
M	NO	NO		
N	YES	NO	YES	
P	NO	YES		
Q	YES	YES		
R	NO	NO		

Controls
A = CXM w/PSC
B = DXM2 w/ECM
C = DXM2 w/PSC

Water Valve & Pump Option
S = No Water Options
M = Standard Water Valve (Normally Closed)
P = Secondary Circulating Pump

AUTO-FLOW REGULATOR (US GPM) CODE

	5/8 SWEAT		7/8 SWEAT				
	UNIT 09	UNIT 12	UNIT 15	UNIT 18	UNIT 24	UNIT 30	UNIT 36
C	1.5	-	-	-	-	-	-
D	2.0	2.0	-	-	-	-	-
E	2.5	2.5	2.5	-	-	-	-
F	3.0	3.0	3.0	3.0	-	-	-
G	-	3.5	3.5	3.5	-	-	-
H	-	-	4.0	4.0	4.0	-	-
J	-	-	-	5.0	5.0	5.0	-
K		-	-	-	6.0	6.0	6.0
L	-	-	-	-	7.0	7.0	7.0
M	-	-	-	-	-	8.0	8.0
N	-	-	-	-	-	-	9.0
P	-	-	-	-	-	-	10.0

S = STANDARD - NO FLOW REGULATOR

Hose Kit

1 2 3	4 5 6	7	8
AHH	0 5 0	3	B

Group
AHH = Accessory Hose Kit Hi-Rise

Hose Size
050 = 1/2" Nominal
075 = 3/4" Nominal
100 = 1" Nominal

Length
3 = Length in Feet

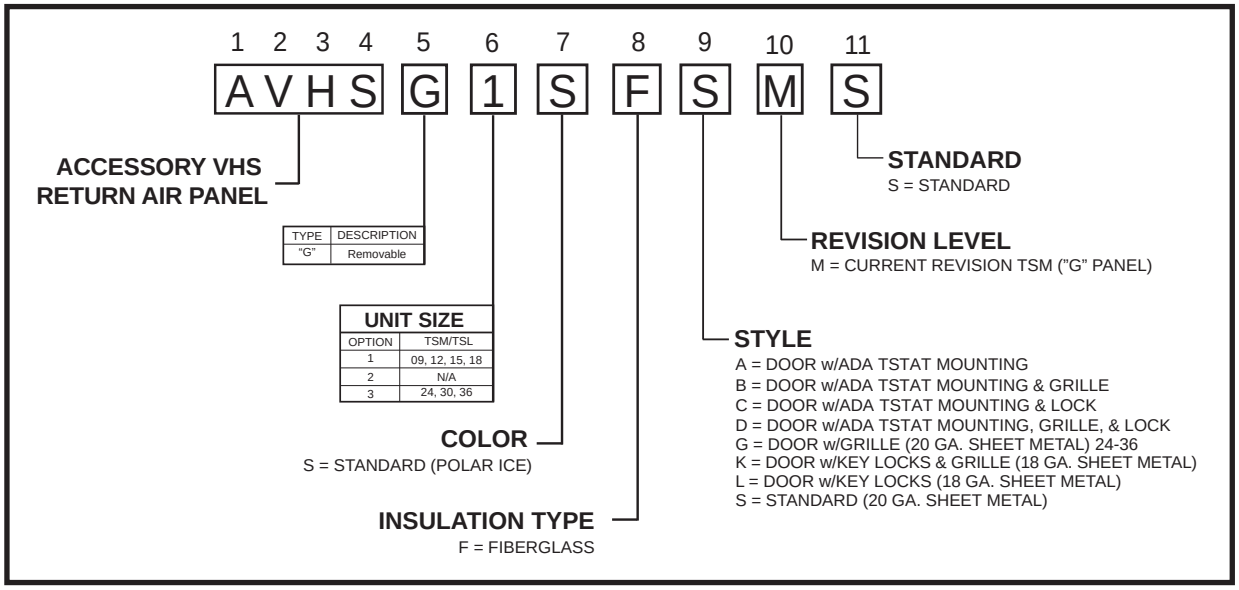
Revision Level
B = Current Revision

TSM Vertical Stack

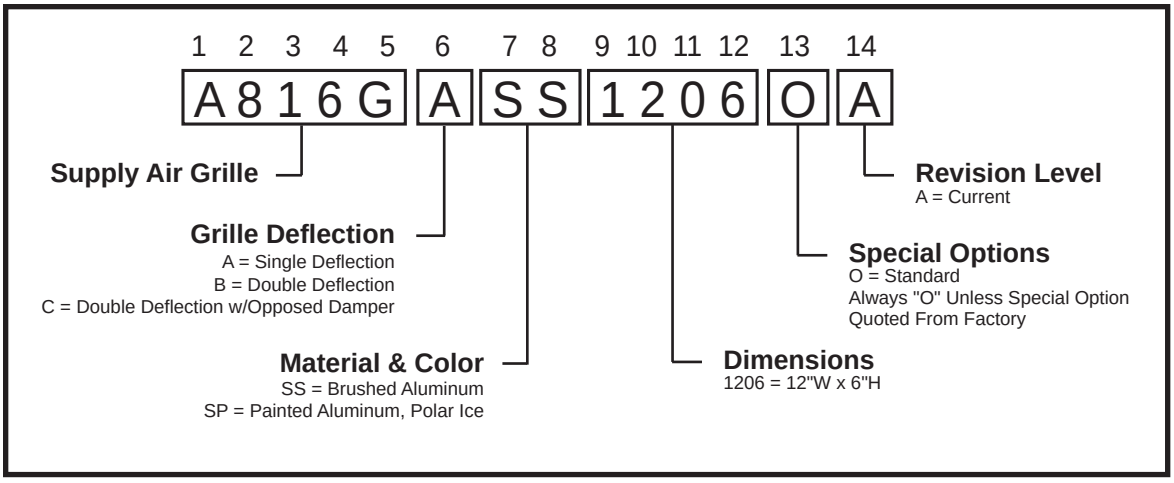
Rev.:08/26/15

Accessory Nomenclature

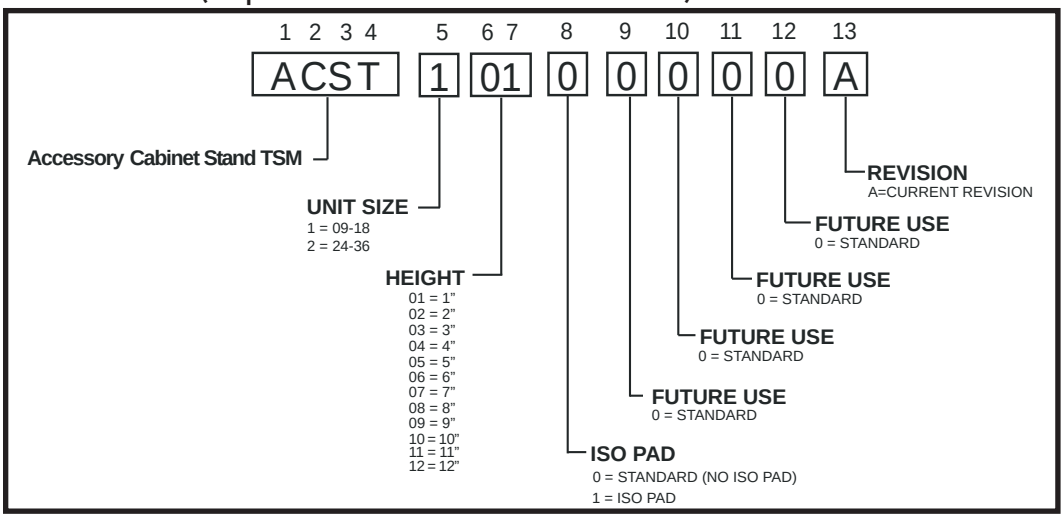
Return Air Panel


1 2 3 4 5 6 7 8 9 10 11
AVHS G 1 S F S M S
ACCESSORY VHS RETURN AIR PANEL
TYPE | DESCRIPTION
"G" | Removable
UNIT SIZE
OPTION | TSM/TSL
1 | 09, 12, 15, 18
2 | N/A
3 | 24, 30, 36
COLOR
S = STANDARD (POLAR ICE)
INSULATION TYPE
F = FIBERGLASS
STYLE
A = DOOR w/ADA TSTAT MOUNTING
B = DOOR w/ADA TSTAT MOUNTING & GRILLE
C = DOOR w/ADA TSTAT MOUNTING & LOCK
D = DOOR w/ADA TSTAT MOUNTING, GRILLE, & LOCK
G = DOOR w/GRILLE (20 GA. SHEET METAL) 24-36
K = DOOR w/KEY LOCKS & GRILLE (18 GA. SHEET METAL)
L = DOOR w/KEY LOCKS (18 GA. SHEET METAL)
S = STANDARD (20 GA. SHEET METAL)
REVISION LEVEL
M = CURRENT REVISION TSM ("G" PANEL)
STANDARD
S = STANDARD

Supply Air Grille


1 2 3 4 5 6 7 8 9 10 11 12 13 14
A816G A SS 1206 O A
Supply Air Grille
Grille Deflection
A = Single Deflection
B = Double Deflection
C = Double Deflection w/Opposed Damper
Material & Color
SS = Brushed Aluminum
SP = Painted Aluminum, Polar Ice
Dimensions
1206 = 12"W x 6"H
Special Options
O = Standard
Always "O" Unless Special Option
Quoted From Factory
Revision Level
A = Current

Cabinet Stands (Ship loose in bulk for field attachment)



Pre-Installation Information

Storage - Equipment should be stored in its original packaging in a clean, dry area. Store chassis in an upright position at all times. Stack units at a maximum of 2 units high.

Store cabinets how they were shipped - horizontal or vertical, keeping them on their pallets for protection. Do not stack multipacks. Cabinets with risers, stack a maximum of 4 high.

Unit Protection - Cover units on the job site with either the original packaging or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, and/or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. All openings in cabinet must be covered during all stages of construction. Physical damage and contamination may prevent proper start-up and may result in costly equipment clean-up.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or debris found in or on these components.

Prior to flushing risers with water, be sure that the temperature in building will always be above freezing.

Pre-Installation - Installation, Operation, and Maintenance instructions are provided with each unit. The installation site chosen should include adequate service clearance around the unit. Before unit installation and start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation. Your installation may require additional, different sequence, or modification to steps in this IOM.

Prepare cabinet for installation as follows:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Each cabinet has a tag to indicate the location to be installed and the riser diameter.
3. Keep the cabinet openings and exposed sheet metal covered until installation is complete and all plastering, painting, etc. is finished and cleaned.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.
5. Configure supply air openings - remove knockouts (K.O.), cut insulation, assemble duct angles with short flange inside cabinet. See model number digits 11 and 12 and Supply Air Grille from schedule, use configurations on page 6. Do not remove extra K.O.'s - must securely cover any open unused K.O.'s.
6. For cabinets without risers - remove correct riser knockouts, slit insulation vertical down center of slot (do not remove).
7. Repair any torn insulation with foil tape.
8. A base vibration dampening pad is recommended to help eliminate transfer of vibration to the structure. If isolation pad was not ordered, obtain of 0.070" to 0.125" (1.5 to 3) thick pad and apply to the perimeter of the cabinet base.
9. For chassis shipped inside cabinet remove and discard 4 shipping bolts.
10. Remove inner panel (8 screws) and save for reinstallation after chassis is installed.
11. For standard cabinets remove and discard condensate pan shipping wire ties.
12. If risers are attached to cabinet, Lift pan approximately 2" to check drain hose is attached and clamped to pan and riser stub.

Prepare chassis for installation as follows:

1. Verify refrigerant tubing is free of kinks or dents and that it does not touch other tubes or unit parts as it passes over or through. Adjust if needed and separate with closed cell insulation.
2. Inspect all electrical connections. Connections must be clean and tight at the terminals.
3. If chassis is not installed in cabinet, store in original carton in a clean and dry location.

⚠ CAUTION! ⚠

CAUTION! DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move and store units in an upright position. Tilting units on their sides may cause equipment damage.

⚠ CAUTION! ⚠

CAUTION! CUT HAZARD - Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing heat pumps.

Riser & Cabinet Installation

⚠ WARNING! ⚠

WARNING! To avoid damage from clogged coil surfaces, clogged motor ventilation openings, seized fan blades and potential unit failure, DO NOT OPERATE UNIT without complete enclosure, supply grille, return air panel and filter in place.

⚠ CAUTION! ⚠

CAUTION! To ensure correct riser positioning and to compensate for variations in floor-to-floor dimensions, do not allow the unit to unit riser joint to bottom out.

Core Drilling For Vertical Riser Stack

Core drilling slab slot/holes will determine cabinet placement and surrounding walls. Slot/holes size, location on floor and plumb alignment in two planes from top to bottom are all very important, check plans. Size of slot/hole will depend on slab thickness, ceiling height, riser length, and if risers are attached to cabinet-which side risers are on and how cabinet is angled into final position. See TSM submittal.

Supply and Return Stack

1. Install a drain valve, shut-off/balancing valves, flow indicators and drain tees at the base of each supply and return riser stack to enable system flushing at start-up, balancing and during servicing.
2. Install strainers at the inlet of each circulating pump.
3. Insulate loop water piping which runs through nonconditioned areas or outside the building. For boiler tower applications loop temperature is normally between 60°F and 90°F, piping does not sweat or suffer heat loss under ambient conditions. For geothermal applications insulate all loop water piping.
4. Cabinet slots and riser stack assemblies are designed to accommodate a maximum of 1-½"(38) expansion and 1-½"(38) contraction. If the calculated riser stack expansion or contraction exceeds 1-½"(38), expansion devices must be provided.
5. For slave cabinets installer must remove riser knockouts (2). See cabinet decoder (Digit 9) for style 2, 3, or 4.

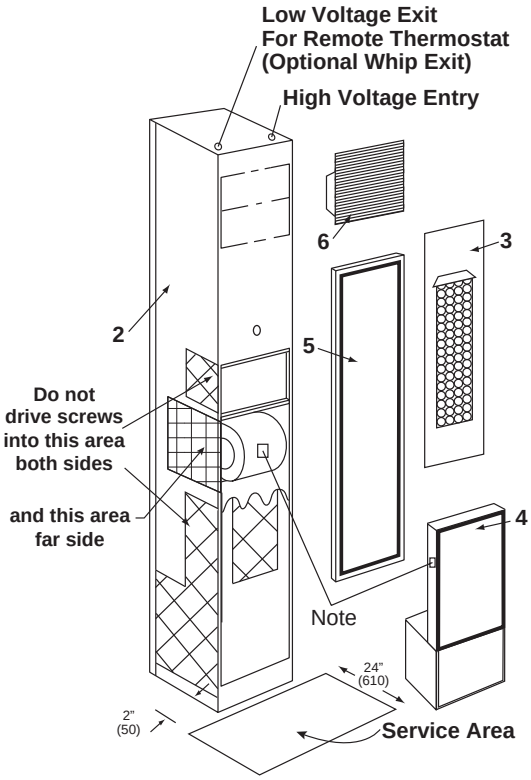
Condensate Piping - Standard and Master Cabinets - Condensate connection between the drain pan assembly and condensate riser is factory installed, clamped, and trapped in cabinet. Slave cabinets installer must remove drain knockout, cut drain hose to length, connect to drain pan and riser, and clamp both ends.

Risers - Risers can be ordered loose, not attached to the cabinet, will be shipped in bulk. Entire riser stacks can be assembled, pressure tested, flushed, and filled before setting cabinets. Use caution if filled risers are in unconditioned space, prevent freezing. Do not construct walls until cabinets are set.

Risers may be different for every location and floor. Risers are not tagged and require a visual inspection for identification.

Figure 1: Vertical Stack Unit Components

1	Supply, Return, and Condensate Risers (not shown)	Install Now
2	Cabinet	
3	Cabinet Inner Panel and Filter	
4	Chassis	Install Later
5	Return Air Panel	
6	Supply Air Grille	
7	Thermostat (Not shown)	
8	Hoses (Not shown)	
9	Optional Stand (Not shown)	
10	Optional Return Panel Filler (Not shown)	



Note: Matching labels for visual aid, chassis, and cabinet same size and voltage.

⚠ WARNING! ⚠

WARNING! To prevent electrical shorts and drain pan leaks, assure that screws do not penetrate unit components when driving screws near the unit control box or drain pan. Do not allow screws or nails to penetrate chassis, risers, electrical junction boxes, raceways or to interfere with chassis removal. To avoid motor or compressor damage, keep wallboard dust out of the unit.

Before brazing check building plans to be sure you are installing correct riser; Description of riser, diameter, type, and shutoff size are all variations. See figure 2 for help in identifying riser and dimension to set riser runout. Note dimension is from bottom of cabinet, add if stand or thick isolation pads are used to get correct dimension from floor.

Description- Supply and return risers can be straight, transition up, transition down, bottom capped, or top capped. Drain risers can be straight, transition up, or top capped. All drain risers and extended range (operation below 60 °F entering water temperature) supply and return risers need insulation.

Riser Diameter (nominal water size)- 1", 1.25", 1.50", 2", 2.5", 3". Top of riser and bottom of riser on floor above must be same diameter.

Type M has red identification marking (stripe running down the tube) and Type L (thicker wall) has blue identification marking. If tube is insulated pull back carefully to check color.

Shutoff size (nominal FPT for hose connection) for cabinet/chassis- ½" for C1 (09) and C2 (12); ¾" for C3 (15) and C4 (18); 1" for C5 (24), C6 (30), and C7 (36).

Supply riser is always closest to back corner of cabinet, return riser next, and drain riser in approx. middle of the cabinet. Risers are 9.25" (235) apart on centerline. See Figure 2 & 3.

Secure Riser Stack to building structure so stack does not drop over time. Cabinet slots allow for 1.50" (38mm) maximum expansion and 1.50" (38mm) maximum contraction, use expansion devices if you exceed these values, and between clamps.

NOTICE: Any risers misplaced, assembled in wrong location, brazed incorrect, modified incorrect (including cutting off or extending), runoff at incorrect height, misalignment found anytime including when cabinets are set, not using expansion devices if specified, or stack was not supported correctly is the sole responsibility of the installing contractor.

Cabinet Installation When Risers are Attached (See Fig. 2)

1. Check plans that cabinet is correct for location, cabinet will have tag and data plate with information, including unit size, diameters of risers, and electrical data. Move cabinet close to slab slot, do not carry cabinet using risers, always use 2 people.
2. Check risers are 3" above the top of cabinet. If not loosen straps, adjust riser and retighten.
3. Configure supply air openings and attach angles. See Pre-Installation. If optional stand is required attach to bottom of cabinet with 4 screws.
4. Start on lowest floor, lift cabinet and angle so risers pass through slab slot/holes until cabinet is standing up and setting on floor. Be careful not to damage either end of riser, do not carry cabinet using risers. Move cabinet until risers are centered in slot/holes and cabinet sides are square with proposed walls. If extensions are used, assemble to risers on lower floor. Mark set depth in case they drop before brazing. Dimension should be 1" to 2". Less than 1" or more than 2-1/2" is not acceptable. Extensions should never bottom in swedge of riser. Note: Riser joints should be well below slab for brazing/inspection.
5. Attach the cabinet assembly to the floor on at least two sides using sheet metal angles. Additional anchorage may be provided by installing brackets at the top of the cabinet.
6. DO NOT attach drywall studs to cabinet. When all units on a riser are anchored into place, complete riser joints as follows:
    a. Verify that all riser joints are vertically aligned and that risers penetrate 1" to 2" (25 to 50) into the swaged joint of the riser below. DO NOT let riser joint bottom out.
    b. Braze riser joints with a high-temperature alloy (such as Phos-copper or Silfos). Soft solder (50-50, 60-40 or 85-15) or low-temperature alloys are NOT suitable for this application.
    c. Must securely anchor riser stacks to the building structure with at least one contact point. Typically at middle floors as needed. Example 40 floor, anchor at 10, 20, and 30. To accommodate vertical expansion and contraction use expansion devices between anchors. DO NOT fasten risers rigidly within the unit.
    d. Verify that unit shut-off valves are closed. DO NOT OPEN VALVES until the system has been cleaned and flushed.
    e. Pressure check riser - locate and repair leaks.
    f. If cabinet is slave, make sure P-Trap Hose is connected and clamped to riser stub and condensate pan. Suggest running copper stub into slave cabinet, cut hose to length, clamp inside cabinet for future access. If condensate hose must be rotated, loosen clamp on pan, rotate, and reclamp. Check condensate drain - clean pan if needed. Slowly pour 1 to 2 quarts (1 to 2 liters) of water into pan. Water should drain freely. Check for water in cabinet and on floor. Repair if needed.
    g. Repair or replace any damaged or missing

insulation on risers, and extensions (if used).

h. To facilitate cleaning and flushing, install the hose kit at the end farthest from the pump and connect the ends of the hoses with the riser flush adapter (Kit - AFL5751). Then open both valves before pumping fresh water through the system, close the valves when the system is clean. Remove the flush adapter before installing the chassis.
Note: Refer to System Flushing Section of this manual for more information.

i. Install air vents in piping loop at highest accessible point as required to bleed the system of air accumulated during installation.

7. Next floor up select correct unit. Suggest measuring from top of slab to top of riser below. Now measure from bottom of cabinet (or stand/pad if used) to bottom of riser, this dimension should be 1" to 2"more than first measurement. Less than 1" or more than 2-1/2" is not acceptable. Risers should never bottom in swedge below. Cut riser or extension if needed. DO NOT slide riser up or down on cabinet. Repeat steps 2-5.

Cabinet Installation when risers separate: See riser and cabinet sections in TSL Submittal 97B0116N01.

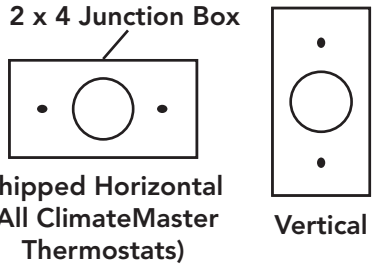
Optional Frame for Return Air Panel - Position studs in front of cabinet and install frame in opening. Seal the gap between the cabinet and the frame. If fresh air motorized damper assembly is used, field fabricate and install duct from outside to frame opening. Assembly is installed later. See instructions with assembly. NOTICE! Allow for drywall thickness under frame front flange.

Optional Field Supplied Duct Installation - When return air is required to enter the unit through openings in a stud wall, supply and field install an optional duct. Seal duct against the return air grille. Add a blockoff above and below the chassis to ensure that all air entering the unit passes through the filter and refrigerant-to-air coil. Sheet metal ductwork must not be attached to the cabinet. A canvas type flexible connection should be used between the cabinet and the ductwork.

⚠ NOTICE! ⚠

NOTICE! ClimateMaster is not responsible for wallboard repair if 2 x 4 box was not in correct orientation.

When supply air is ducted from unit, sheet metal ductwork



must not be attached to the cabinet. A canvas-type flexible connection should be used between the cabinet and the ductwork.

Drywall Installation: If you have the surface mounted thermostat option (cabinet model digit 5 = P or S), make sure before you install the drywall that the 2x4 junction box is in the correct orientation. Turn if needed. Check your thermostat.

For best sound attenuation, it is recommended not to attach drywall to cabinet.

Install studs and drywall using conventional construction methods. Secure drywall to studs with low profile, pan-head sheet metal screws. Drywall must not be fastened to drain pan edges or control box enclosure. Drywall can be attached directly to cabinet (except in places indicated in Figure 1), front of cabinet requires double thickness. Do not attach drywall studs to cabinet. Do not install drywall using adhesive alone.

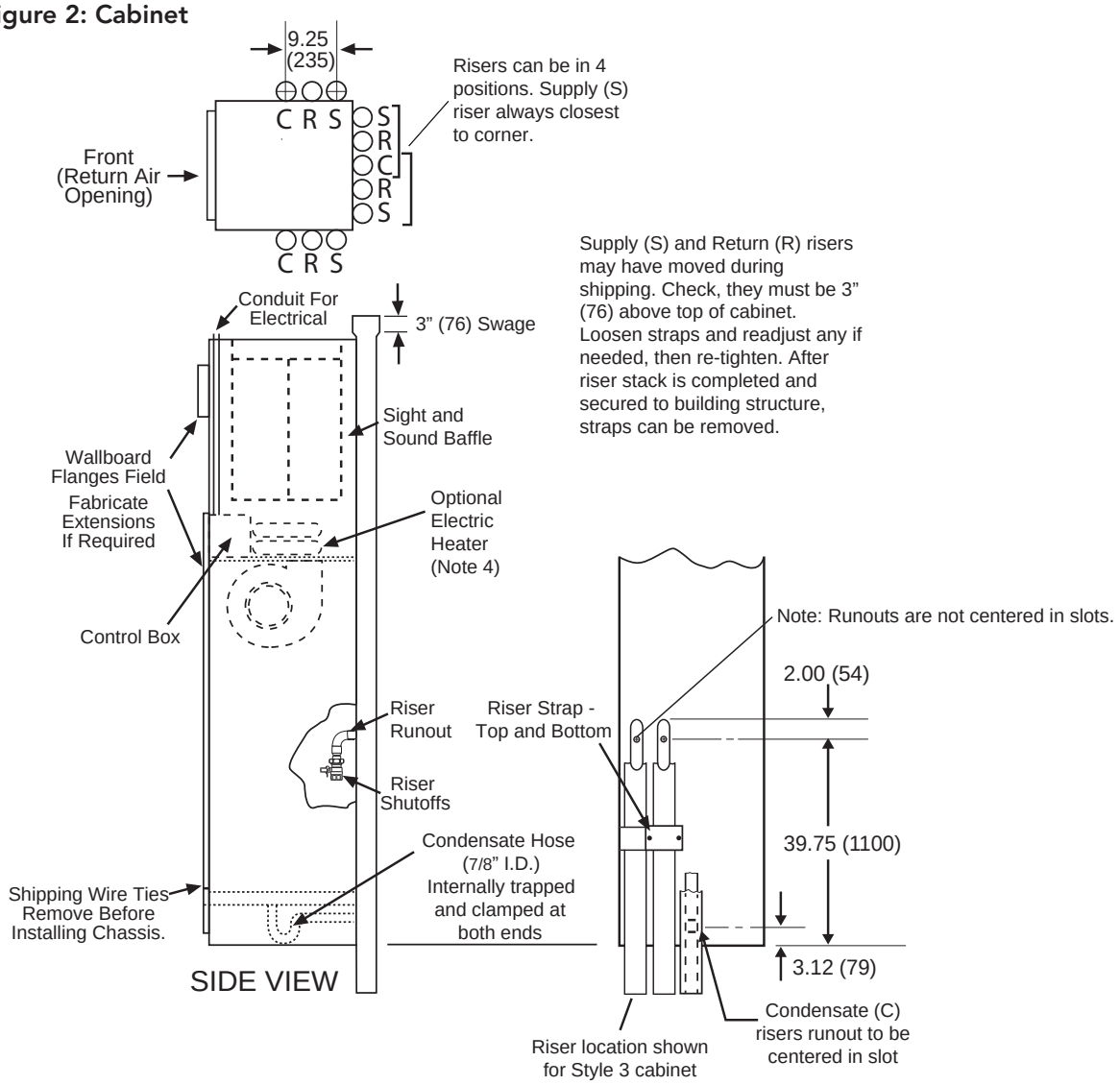
See typical construction figures 4, 5, and 6 to determine stud layouts and dimension from cabinet to finished wall. Vacuum all drywall dust and construction debris from cabinet insulation, drain pans and blower discharge plenum after cutting out supply and return holes for grilles. Insulation should be placed between the drywall and the cabinet for sound attenuation.

When installation is complete, cover all cabinet openings and exposed sheet metal. (Cardboard from unit shipping cartons can be used). Do not allow paint or wall texture over-spray to contact insulation, sheet metal, coil, fan or other unit components. Warranties are void if paint or other foreign debris is allowed to contaminate internal unit components.

Do not adjust the Sight and Sound X-baffle (see Figure 2). It is not designed to be used as a damper.

Cabinet Installation

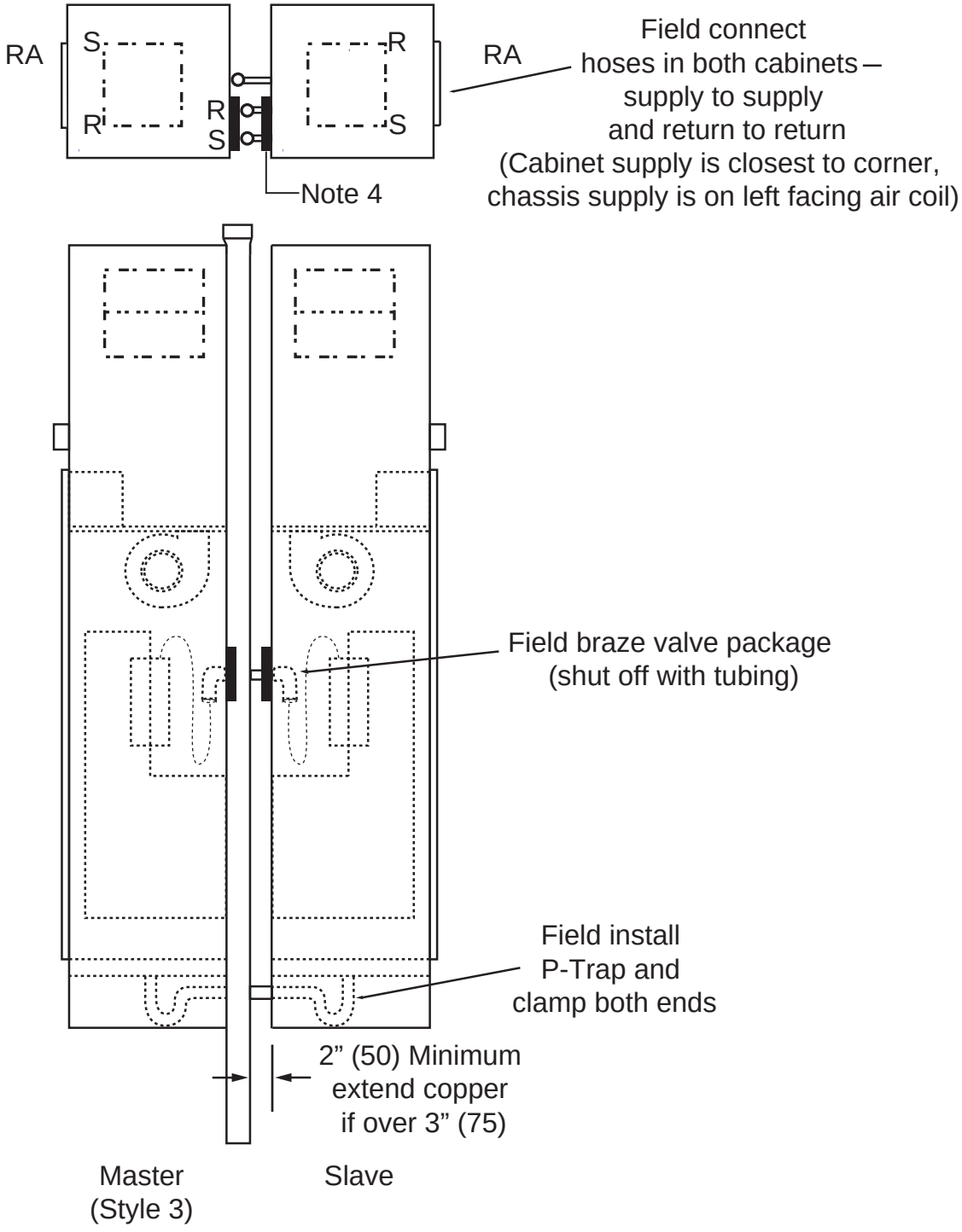
Figure 2: Cabinet


9.25
(235)
C R S
S
R
C
R
S
C R S
Risers can be in 4 positions. Supply (S) riser always closest to corner.
Front
(Return Air Opening)
Supply (S) and Return (R) risers may have moved during shipping. Check, they must be 3" (76) above top of cabinet. Loosen straps and readjust any if needed, then re-tighten. After riser stack is completed and secured to building structure, straps can be removed.
Conduit For Electrical
3" (76) Swage
Sight and Sound Baffle
Wallboard Flanges Field
Fabricate Extensions If Required
Optional Electric Heater (Note 4)
Control Box
Riser Runout
Riser Shutoffs
Riser Strap - Top and Bottom
Note: Runouts are not centered in slots.
2.00 (54)
39.75 (1100)
3.12 (79)
Condensate Hose (7/8" I.D.) Internally trapped and clamped at both ends
Shipping Wire Ties Remove Before Installing Chassis.
SIDE VIEW
Riser location shown for Style 3 cabinet
Condensate (C) risers runout to be centered in slot

Notes:

1. For chassis shipped in cabinet remove and discard 4 shipping bolts.
2. Supply (S) and Return (R) risers may have moved during shipping. Check, they must be 3" (76) above top of cabinet. Loosen straps and readjust any if needed, then re-tighten. After riser stack is completed and secured to building structure, straps can be removed..
3. Before installing chassis – check drain hose is connected and clamped at both ends, and drain pan is free and setting on 4 rubber grommets.
4. Optional Electric Heater – Single point power to unit.

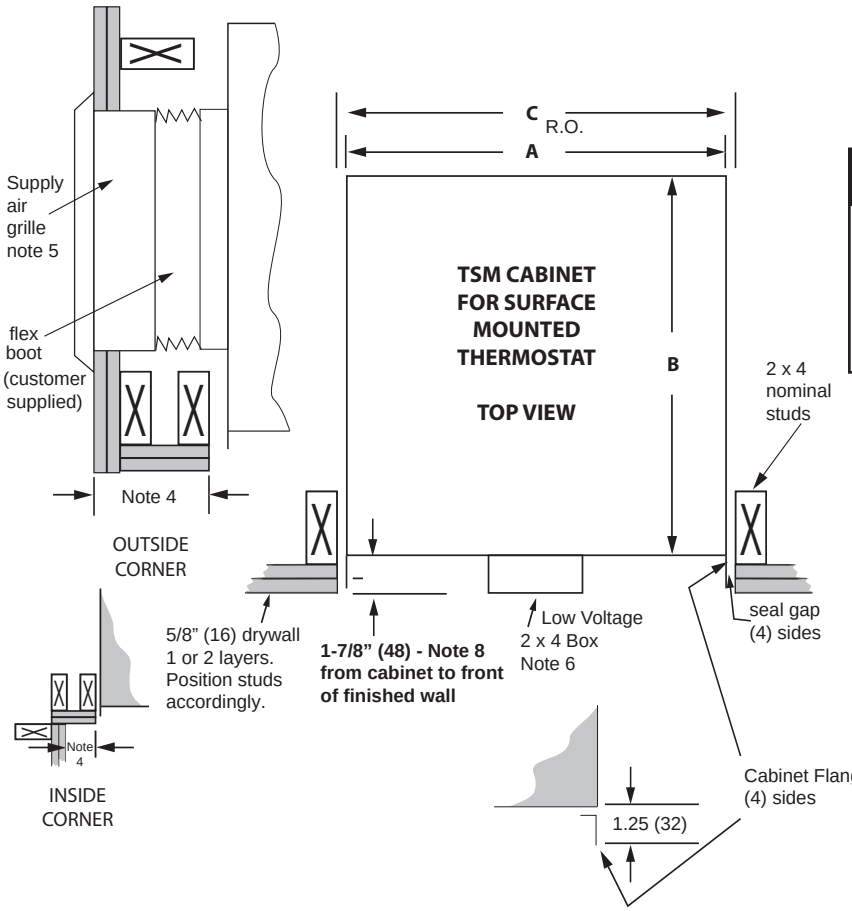
Master/Slave Cabinet Installation



Notes:

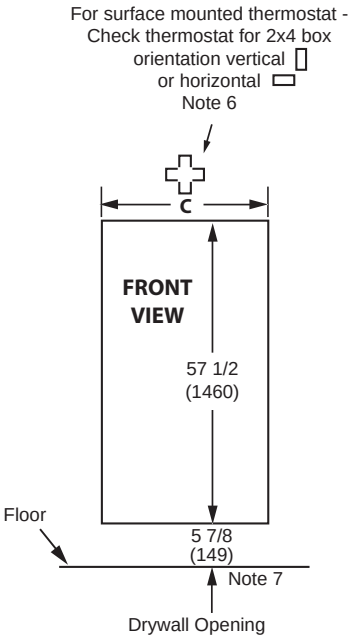
1. Contractor must meet all fire code requirements.
2. Size riser diameter for both units GPM.
3. Master/Slave means both units share common riser.
4. Install pads on back of slave cabinet to cover slots used for S/R risers.

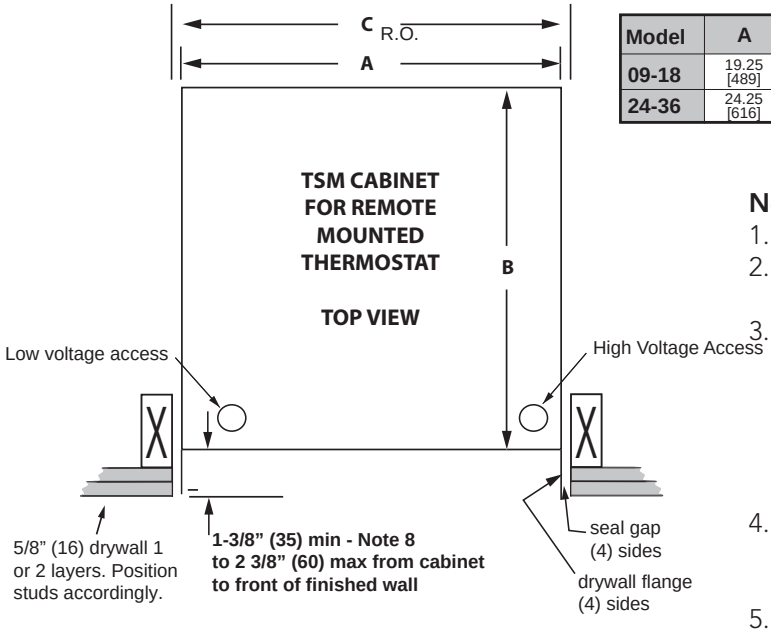
Typical Cabinet Installation - Flush



⚠ NOTICE! ⚠

Seal between studs and cabinet flanges with weather tight foam material to prevent wall cavity air from infiltrating unit or room.




C
R.O.
A
TSM CABINET FOR REMOTE MOUNTED THERMOSTAT
TOP VIEW
B
Low voltage access
High Voltage Access
5/8" (16) drywall 1 or 2 layers. Position studs accordingly.
1-3/8" (35) min - Note 8 to 2 3/8" (60) max from cabinet to front of finished wall
seal gap (4) sides
drywall flange (4) sides

Model	A	B	C
09-18	19.25 [489]	19 [483]	19.5 [495]
24-36	24.25 [616]	24 [610]	24.5 [622]

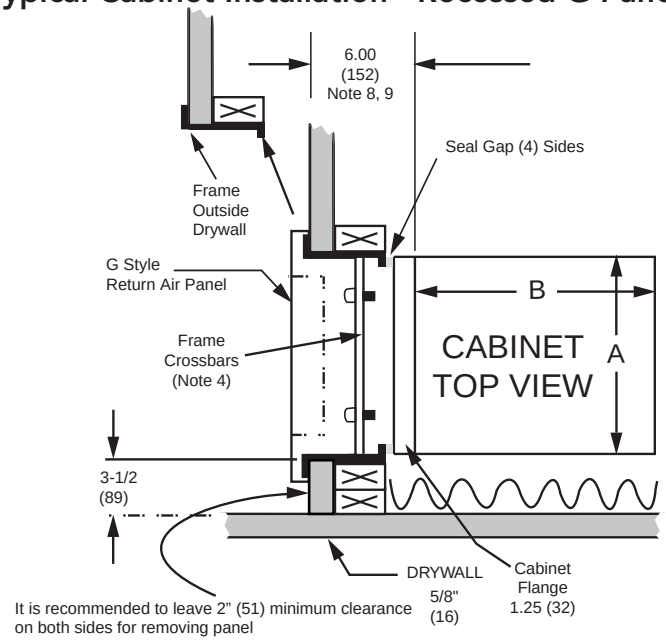
Notes:

1. All dimensions are in inches (mm).
2. Cabinet configuration will determine slab core drilling location and walls surrounding cabinet.
3. Recommend stud walls surrounding cabinet. Drywall and studs should not be attached or contacting cabinet for best sound attenuation. Where possible fill gaps with sound absorbing material. Use iso pad under cabinet. Secure cabinet to floor in two places at back.
4. Return air panel (not shown) overlaps rough opening, allow minimum of 3 1/2" (89) dry wall to corner. Do not caulk panel to wall.
5. If supply air grille does not penetrate cabinet connect with flex boot. Customer supplied top duct should also connect with flex boot.
6. Before installing dry wall, contractor must turn box if needed. Horizontal is standard.
7. If cabinet stand or ISO pad is used add to dimension.
8. For 2"(50) filter set cabinet 2"(50) minimum from front of drywall.

TSM Vertical Stack

Rev.:08/26/15

Typical Cabinet Installation - Recessed G Panel

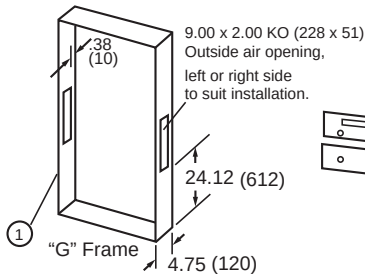


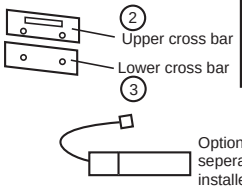
⚠ NOTICE! ⚠

Recessed cabinet requires frame kit.
Outside air requires motorized damper.
Seal between the frame and cabinet with weather seal material to avoid air being pulled in from the wall cavity. Attach frame to studs not cabinet.
Do not distort frame shim sides if required.

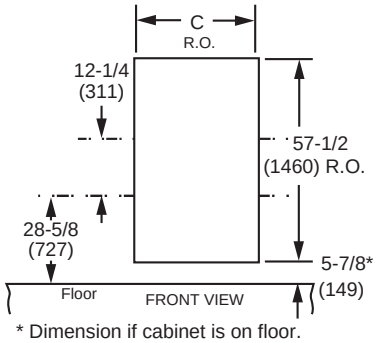
Notes:

1. Cabinet configuration will determine slab core drilling location and walls surrounding cabinet.
2. Recommend stud walls surrounding cabinet. Drywall and studs should not be attached or contacting cabinet for best sound attenuation. Where possible fill gaps with sound absorbing material. Use iso pad under cabinet. Secure cabinet to floor in two places at back.
3. Return air panel overlaps rough opening, allow minimum of 3 1/2" (89) dry wall to corner. Do not caulk panel to wall.
4. G Panel attaches to frame cross bars. Cabinet must be recessed behind wall.
5. Dimensions are in inches (mm). All studs nominal 2x4, 1.50 (38) x 3.50 (89).
6. For filter access, pivot inner panel, open filter access snap. For chassis removal, remove G Panel, remove 2 cross bars, remove filter panel, slide out chassis.
7. **When outside air is required, 48A0100N04 motorized damper must be used, mixed air temperature must be no lower than 45°F (7°C), no higher than 95 DB/75 WB, and not exceed 20% of total CFM. Contractor must supply air duct, cut hole in stud, remove K.O., assemble and wire damper assembly.**
   Note: Use extreme weather temperatures.
8. For 2" filter set cabinet 6.25" (158) from front of drywall.
9. If drywall flanges (2) are removed, cabinet can be set 1" (25) closer to finished wall.





Kit Part	Qty	Description
1	1	Frame
2	1	Upper Cross Bar
3	1	Lower Cross Bar



		Frame Kit			Panel
Kit	Size	A	B	C	D
48A0100N51	09-18	19.25 (489)	19 (483)	19-5/8 (498)	21.50 (546)
48A0100N52	24-36	24.25 (616)	24 (610)	24-3/8 (620)	25.50 (648)

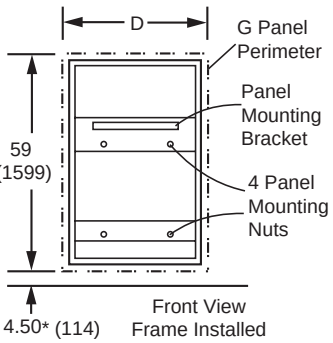
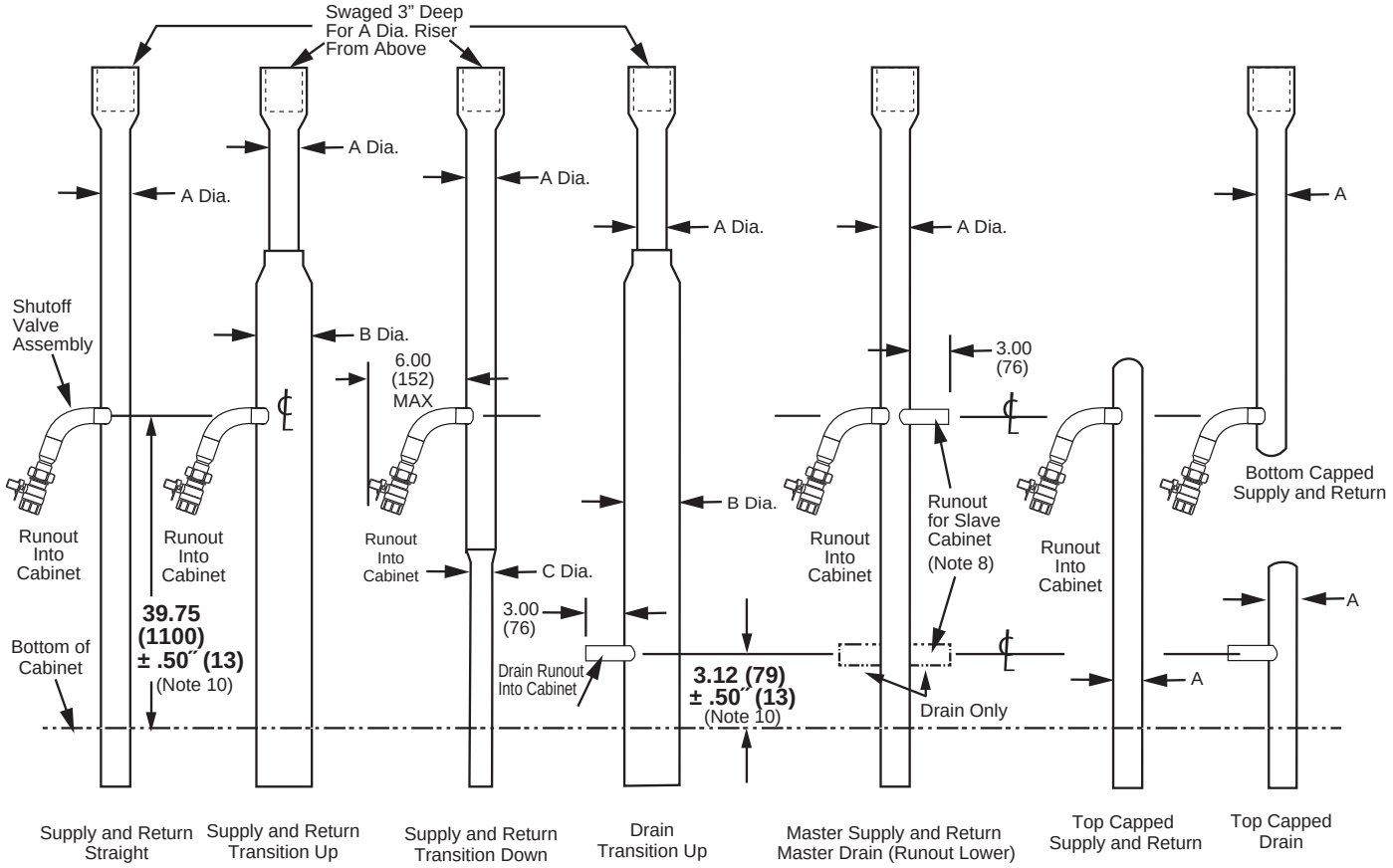


Figure 3: Riser Identification


Swaged 3" Deep For A Dia. Riser From Above
A Dia.
B Dia.
C Dia.
Shutoff Valve Assembly
6.00 (152) MAX
3.00 (76)
Runout Into Cabinet
Runout for Slave Cabinet (Note 8)
Bottom Capped Supply and Return
Bottom of Cabinet
39.75 (1100) ± .50˝ (13) (Note 10)
Drain Runout Into Cabinet
3.12 (79) ± .50˝ (13) (Note 10)
Drain Only
Supply and Return Straight
Supply and Return Transition Up
Supply and Return Transition Down
Drain Transition Up
Master Supply and Return Master Drain (Runout Lower)
Top Capped Supply and Return
Top Capped Drain

Notes:

1. You must know water flow direction to determine if cabinet requires transition up or down.
2. Transitions can only change by one diameter (1" to 1¼", 1¼" to 1½", etc.)
3. Riser transition couplings and runouts are factory brazed.
4. All risers are factory pressure tested.
5. Standard riser diameters are 1", 1¼", 1½", 2", 2½" and 3"nominal water tubing.
6. Copper Type M and L available.
7. Drain riser insulated standard. Supply and return insulated optional.
8. Master riser - contractor provides tubing from runout to slave cabinet if needed and brazes shutoff for slave.
9. Shutoff has FPT for hose (1/2" for C1(09), C2(12); 3/4" for C3(15), C4(18); or 1" for C5(24), C6(30), C7(36).
10. Position runout perpendicular to side of cabinet.

A	1.00	1.25	1.50	2.00	2.50	3.00
B	1.25	1.50	2.00	2.50	3.00	-
C	-	1.00	1.25	1.50	2.00	2.50

Note - All ClimateMaster units with optional motorized valve have water high pressure switches. Do not design riser stack where switch will not reset. (Trip - 300 PSI; Reset - 250 PSI)

Supply Grille Installation - Cabinet opening should be sealed to wall. Use canvas-type flex collar or field supplied duct extension if needed.

Refer to Table 1 to make sure that the grille size is correct based on the type and size of the supply air grille.

- Install the grille into the cabinet discharge opening. Assure that the grille flange rests against the drywall covering the cabinet. Do not caulk.
- Secure the grille to the drywall with the screws provided.

Table 1: Supply Grille Sizes and Arrangements

Unit Size	Single Discharge	Double Discharge	Triple Discharge
TSM09	12" x 12" (305 x 305)	12" x 6" (305 x 152)	N/A
TSM12	12" x 12" (305 x 305)	12" x 6" (305 x 152)	N/A
TSM15	12" x 12" (305 x 305)	12" x 6" (305 x 152)	12" x 6" (305 x 152)
TSM18	N/A	12" x 12" (305 x 305)	12" x 6" (305 x 152)
TSM24	N/A	16" x 8" (406 x 203)	16" x 8" (406 x 203)
TSM30	N/A	16" x * (406 x –)	16" x 8" (406 x 203)
TSM36	N/A	16" x * (406 x –)	16" x * (406 x –)

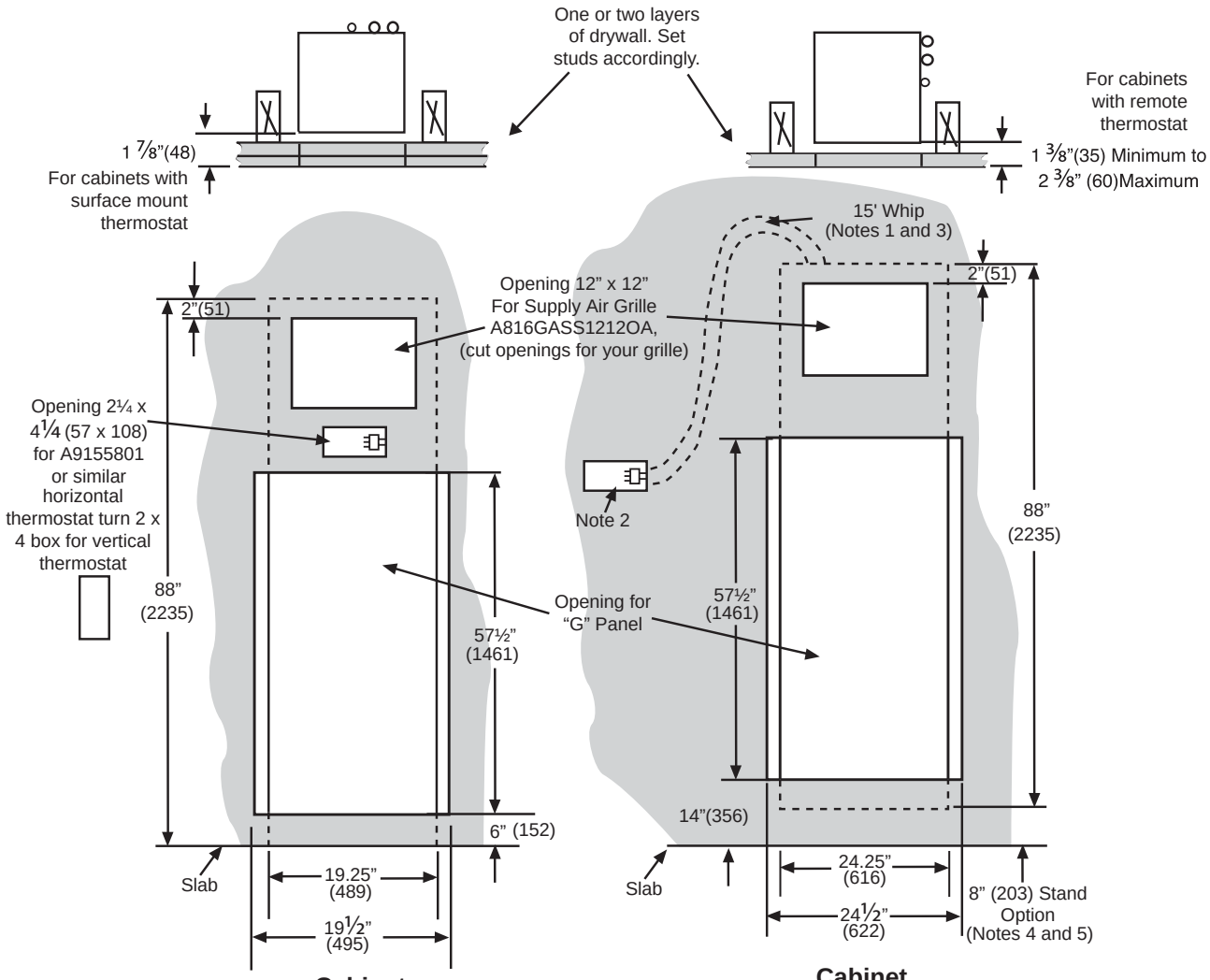
Note - If custom grille sizes are used, area should equal above.

* – 88" (2235) Cabinet = 16" (406); 80" (2032) Cabinet = 12" (305)

TSM Vertical Stack

Rev.:08/26/15

NOTICE - Drywall openings shown below are for specific cabinets, indicated below.
Cut openings for your cabinet, supply air grille, and thermostat.


One or two layers of drywall. Set studs accordingly.
1 7/8"(48)
For cabinets with surface mount thermostat
For cabinets with remote thermostat
1 3/8"(35) Minimum to 2 3/8" (60)Maximum
15' Whip (Notes 1 and 3)
2"(51)
Opening 12" x 12" For Supply Air Grille A816GASS1212OA, (cut openings for your grille)
Opening 2¼ x 4¼ (57 x 108) for A9155801 or similar horizontal thermostat turn 2 x 4 box for vertical thermostat
Note 2
88" (2235)
57½" (1461)
Opening for "G" Panel
6" (152)
Slab
19.25" (489)
19½" (495)
14"(356)
24.25" (616)
24½" (622)
8" (203) Stand Option (Notes 4 and 5)

Cabinet Fig. 4

Drywall Openings for C1G0PAC1303000A and G Panel on floor

Cabinet Fig. 5

Drywall Openings for C5G0RAA1502010A and G Panel With 8" Stand

Notes:

1. All factory-installed whips end with 9 pin molex connector.
2. Field-supplied 2x4 Box must be a type that the side can be removed so molex can be put inside. Position box horizontal or vertical for thermostat.
3. Optional 15, 25, or 35 foot whips (thermostat cable Class 2) available. Whips in BX armor available as special.
4. 1" to 12"(25 to 305) stands available, stands are bulk shipped and must be field installed.
5. When stands or ISO pads are used, make sure riser length and position is calculated correctly. 3" above and tailpiece always from bottom of cabinet. Stand or ISO pads raises everything up.
6. For 2" filter, set cabinet 2" (50) minimum from front of drywall.

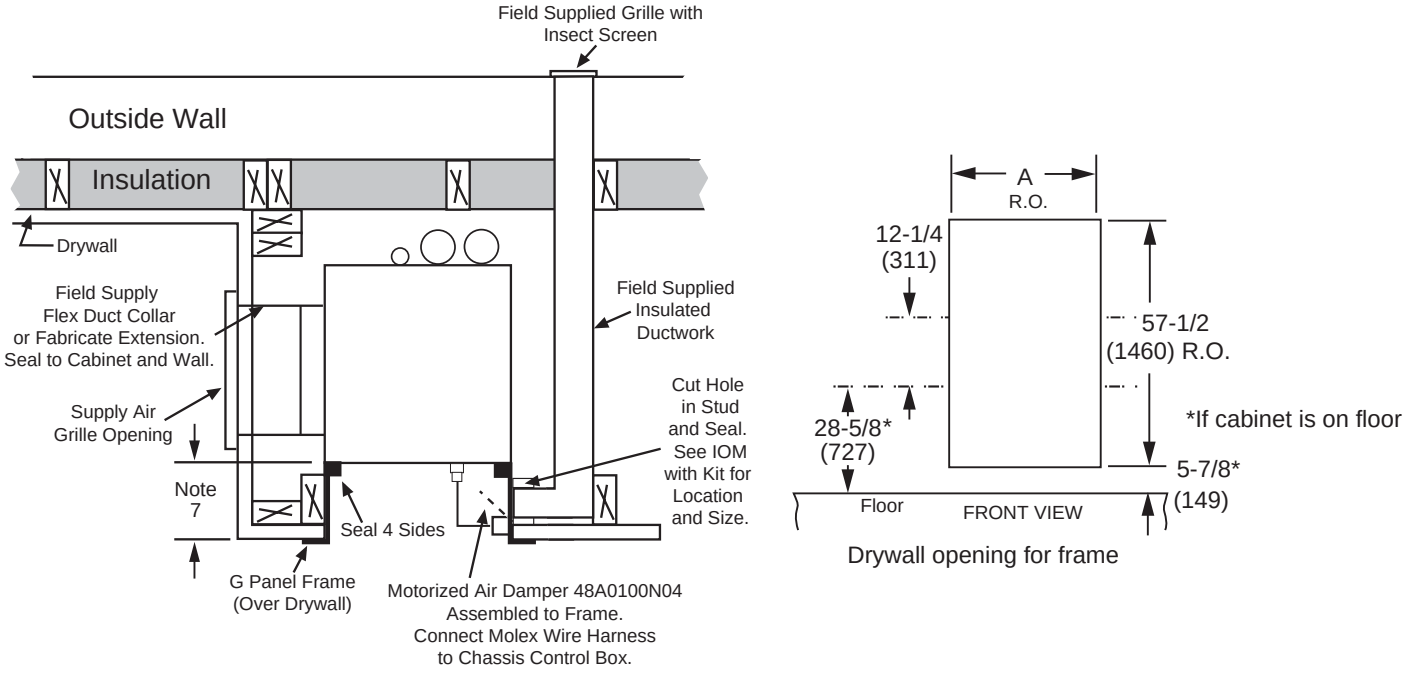


Fig 6

TOP VIEW

Cabinet with G Panel Frame and Optional Outside Air Duct (Field Fabricated)

Models	Frame	A
For 09-18	48A0100N51	19 5/8 (498)
For 24-36	48A0100N52	24 3/8 (620)

Notes:

1. All units with outside air option must use motorized air damper. Damper to be closed when unit not operating.
2. Duct can be on right or left side.
3. On all installations, mixed return air to unit must be 45°F (7°C) to 95°F (35°C), and not exceed 20% of total CFM.
4. On all installations, the ambient temperature behind interior wall must be above freezing.
5. Prevent condensate on all installations of risers and loop piping insulate if required.
6. Frame attaches to studs, do not distort shim if required.
7. Cabinets with 1" (25) filter rack remove 2 side cabinet flanges, set back 4.75" (121) minimum; 2" (50) filter rack set back 6.25" (159) minimum.
8. Seal 4 sides between frame and cabinet use foam, foil tape, caulk, or field fabricated sheet metal.

Water-Loop Heat Pump Applications

Commercial Water Loop Applications - Commercial systems typically include a number of units connected to a common piping system with a cooling tower and boiler. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. In piping systems expected to utilize water temperatures below 50°F [10°C], 1/2" (13mm) closed cell insulation is required on all piping surfaces to eliminate condensation (extended range units required). Metal to plastic threaded joints should never be used due to their tendency to leak over time.

Teflon tape thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from ClimateMaster. The piping system should be flushed to remove dirt, piping chips, and other foreign material prior to operation (see "Piping System Cleaning and Flushing Procedures" in this manual). The flow rate is usually set between 2.25 and 3.5 gpm per ton [2.9 and 4.5 l/m per kW] of cooling capacity. ClimateMaster recommends 3 gpm per ton [3.9 l/m per kW] for most applications of water loop heat pumps.

Water loop heat pump (cooling tower/boiler) systems typically utilize a common loop, maintained between 60 and 90°F [16 - 32°C]. The use of a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary. Units equipped with any of the two vFlow configurations have built in Schrader ports. Water temperature may be viewed on the iGate communicating thermostat or service tool.

Water Quality Standards - Table 3 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH <7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indecies should be calculated. Use the appropriate scaling surface temperature for the application, 150°F [66°C] for direct use (well water/open loop) and DHW (desuperheater); 90°F [32°F] for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 3.

Ground-Loop Heat Pump Applications

⚠ CAUTION! ⚠

CAUTION! The following instructions represent industry accepted installation practices for closed loop earth coupled heat pump systems. Instructions are provided to assist the contractor in installing trouble free ground loops. These instructions are recommendations only. State/provincial and local codes MUST be followed and installation MUST conform to ALL applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

⚠ CAUTION! ⚠

CAUTION! Ground loop applications require extended range equipment and optional refrigerant/water circuit insulation.

Pre-Installation - Prior to installation, locate and mark all existing underground utilities, piping, etc. Install loops for new construction before sidewalks, patios, driveways, and other construction has begun. During construction, accurately mark all ground loop piping on the plot plan as an aid in avoiding potential future damage to the installation.

Piping Installation - All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop. Galvanized or steel fittings should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided due to their potential to leak in earth coupled applications. A flanged fitting should be substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger. Units equipped with any of the two vFlow configurations have built in Schrader ports. Water temperature may be viewed on the iGate communicating thermostat or service tool.

Earth loop temperatures can range between 25 and 110°F [-4 to 43°C]. Flow rates between 2.25 and 3 gpm per ton [2.41 to 3.23 l/m per kW] of cooling capacity is recommended in these applications.

Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. Pressures of at least 100 psi [689 kPa] should be used when testing. Do not exceed the pipe pressure rating. Test entire system when all loops are assembled.

Flushing the Earth Loop - Upon completion of system installation and testing, flush the system to remove all foreign objects and purge to remove all air.

Water Quality Standards - Table 3 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH <7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indecies should be calculated. Use the appropriate scaling surface temperature for the application, 150°F [66°C] for direct use (well water/open loop) and DHW (desuperheater); 90°F [32°F] for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 3.

Antifreeze - If any liquid fluid or piping is exposed to unconditioned ambient below 42°F (5.5 C), antifreeze must be added. If the liquid fluid entering the heat pump is 50°F (10°C) or below, calculate the leaving heat pump temperature (shown in submittal on performance data selection notes section). Using the lowest temperature leaving the heat pump, must protect system 15°F (8°C) lower. IE: if temperature leaving the heat pump is 35°F subtract 15°F = 20°F protection required, if Methanol is used the system would require 16% mix by volume. Antifreeze is available in alcohol and glycols, contact local sales office for the best type for your system and area. Following must be considered safety, thermal performance, corrosiveness, local codes, stability, convenience, and cost.

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in table 2 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

Low Water Temperature Cutout Setting - CXM Control
When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual). **Note: Low water temperature operation requires extended range equipment.**

Table 2: Antifreeze Percentages by Volume

	Minimum temperature leaving the unit F (C)			
	25 (-4)	30 (-1)	35 (1.5)	42 (5.5)
	Protect liquid fluid to			
Type	10 (-12)	15 (-9)	20 (-6.5)	25 (-2.5)
Methanol	25%	21%	16%	10%
100% Food Grade PG	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

*Ethanol must not be denatured with any petroleum based product

CXM/DXM - must clip LT1 jumper if antifreeze is used. DO NOT clip without antifreeze.

Check with hydrometer after pump has mixed fluid well, now and at beginning of each heating season.

Ground-Water Heat Pump Applications

Open Loop - Ground Water Systems - Shut off valves should be included for ease of servicing. Boiler drains or other valves should be "tee'd" into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system. P/T plugs should be used so that pressure drop and temperature can be measured. Piping materials should be limited to copper or PVC SCH80. **Note: Due to the pressure and temperature extremes, PVC SCH40 is not recommended.**

Water quantity should be plentiful and of good quality. Consult Table 4 for water quality guidelines. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Consult Table 4 for recommendations. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may over time lose heat exchange capabilities due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing. In some cases, the desuperheater option should not be recommended due to hard water conditions and additional maintenance required.

Water Quality Standards - Table 3 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH <7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indecies should be calculated. Use the appropriate scaling surface temperature for the application, 150°F [66°C] for direct use (well water/open loop) and DHW (desuperheater); 90°F [32°F] for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 3.

Expansion Tank and Pump - Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. The expansion tank should be sized to provide at least one minute continuous run time of the pump using its drawdown capacity rating to prevent pump short cycling. Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local building codes (e.g. recharge well, storm sewer, drain field, adjacent stream or pond, etc.). Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area. Units equipped with any of the two vFlow configurations have built in Schrader ports. Water temperature may be viewed on the iGate communicating thermostat or service tool.

Water Control Valve - Always maintain water pressure in the heat exchanger by placing the water control valve(s) on the return line to prevent mineral precipitation during the off-cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Ensure that the total 'VA' draw of the valve can be supplied by the unit transformer. For instance, a slow closing valve can draw up to 35VA. This can overload smaller 40 or 50 VA transformers depending on the other controls in the circuit. A typical pilot operated solenoid valve draws approximately 15VA.

Flow Regulation - Flow regulation can be accomplished by two methods. One method of flow regulation involves simply adjusting the ball valve or water control valve on the return line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from. Since the pressure is constantly varying, two pressure gauges may be needed. Adjust the valve until the desired flow of 1.5 to 2 gpm per ton [2.0 to 2.6 l/m per kW] is achieved. A second method of flow control requires a flow control device mounted on the outlet of the water control valve. The device is typically a brass fitting with an orifice of rubber or plastic material that is designed to allow a specified flow rate. On occasion, flow control devices may produce velocity noise that can be reduced by applying some back pressure from the ball valve located on the discharge line. Slightly closing the valve will spread the pressure drop over both devices, lessening the velocity noise. **Note: When EWT is below 50°F [10°C], 2 gpm per ton (2.6 l/m per kW) is required.**

Water Coil Low Temperature Limit Setting - For all open loop systems, CXM/DXM JW3 Jumper (LT1) should **never** be clipped to avoid freeze damage to the unit, and voiding your warranty. See "Low Water Temperature Cutout Selection" in this manual for details on the low limit setting.

NOTICE! Ground-water applications for commercial buildings with more than 2-3 units should include a plate frame heat-exchanger to isolate the heat pumps from the ground-water and confine heat exchanger cleanings to one location and lessen maintenance. Direct use of ground-water may increase the frequency of heat pump maintenance and may shorten life expectancy.

Water Quality Standards

The ClimateMaster Water Quality Table provides water quality requirements for ClimateMaster coaxial heat exchangers. When water properties are outside of those requirements, an external secondary heat exchanger must be used to isolate the heat pump heat exchanger from the unsuitable water. Failure to do so will void the warranty for the coaxial heat exchanger.

Table 3: Water Quality Standards

Water Quality Parameter	HX Material	Closed Recirculating	Open Loop and Recirculating Well		
Scaling Potential - Primary Measurement					
Above the given limits, scaling is likely to occur. Scaling indexes should be calculated using the limits below					
pH/Calcium Hardness Method	All	-	**pH < 7.5 and Ca Hardness <100ppm**		
Index Limits for Probable Scaling Situations - (Operation outside these limits is not recommended)					
Scaling indexes should be calculated at 66°C for direct use and HWG applications, and at 32°C for indirect HX use. A monitoring plan should be implemented.					
Ryznar Stability Index	All	-	**6.0 - 7.5** If >7.5 minimize steel pipe use.		
Langelier Saturation Index	All	-	**-0.5 to +0.5** If <-0.5 minimize steel pipe use. Based upon 66°C HWG and Direct well, 29°C Indirect Well HX		
Iron Fouling					
Iron Fe $^{2+}$ (Ferrous) (Bacterial Iron potential)	All	-	**<0.2 ppm (Ferrous)** If Fe^{2+} (ferrous)>0.2 ppm with pH 6 - 8, O2<5 ppm check for iron bacteria.		
Iron Fouling	All	-	**<0.5 ppm of Oxygen** Above this level deposition will occur.		
Corrosion Prevention					
pH	All	**6 - 8.5** Monitor/treat as needed	**6 - 8.5** Minimize steel pipe below 7 and no open tanks with pH <8		
Hydrogen Sulfide (H_2S)	All	-	**<0.5 ppm** At H_2S>0.2 ppm, avoid use of copper and copper nickel piping or HX's. Rotten egg smell appears at 0.5 ppm level. Copper alloy (bronze or brass) cast components are OK to <0.5 ppm.		
Ammonia ion as hydroxide, chloride, nitrate and sulfate compounds	All	-	**<0.5 ppm**		
Maximum Chloride Levels			Maximum Allowable at maximum water temperature.		
			10°C	24°C	38 °C
	Copper	-	<20ppm	NR	NR
	Cupronickel	-	<150 ppm	NR	NR
	304 SS	-	<400 ppm	<250 ppm	<150 ppm
	316 SS	-	<1000 ppm	<550 ppm	< 375 ppm
	Titanium	-	>1000 ppm	>550 ppm	>375 ppm
Erosion and Clogging					
Particulate Size and Erosion	All	<10 ppm of particles and a maximum velocity of 1.8 m/s Filtered for maximum 841 micron [0.84 mm, 20 mesh] size.	<10 ppm (<1 ppm "sandfree" for reinjection) of particles and a maximum velocity of 1.8 m/s. Filtered for maximum 841 micron 0.84 mm, 20 mesh] size. Any particulate that is not removed can potentially clog components.		

The ClimateMaster Water Quality Table provides water quality requirements for ClimateMaster coaxial heat exchangers. The water should be evaluated by an independent testing facility comparing to this Table and when properties are outside of these requirements, an external secondary heat exchanger must be used to isolate the heat pump heat exchanger from the unsuitable water. Failure to do so will void the warranty for the coaxial heat exchanger and any other components damaged by a leak.

Rev.: 5/6/2014 S

Notes:

- Closed Recirculating system is identified by a closed pressurized piping system.
- Recirculating open wells should observe the open recirculating design considerations.
- NR - Application not recommended.
- "-" No design Maximum.

Electrical Wiring - Line Voltage

⚠ WARNING! ⚠

WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

⚠ CAUTION! ⚠

CAUTION! Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Electrical - Line Voltage
All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor.All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

⚠ WARNING! ⚠

WARNING! Disconnect electrical power source to prevent injury or death from electrical shock.

General Line Voltage Wiring - Be sure the available power is the same voltage and phase shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Power Connection - Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the contactor.

208 Volt Operation - All commercial 208/230 Volt units are factory wired for 208 Volt operation. If supply voltage is 230V, then the transformer must be rewired to the 230V tap as illustrated on the wiring diagram by switching the red (208V) and the orange (230V) wires at the contactor terminal.

Blower Speed Selection – Units with PSC Motor
PSC (Permanent Split Capacitor) blower fan speed can be changed by moving the speed tap wires on the fan motor terminal block. See Figure 7.
Note: Check blower table 4 and 5, must maintain minimum CFM for your external static.

Blower Speed Selection – Units with ECM Motor
CFM can be changed from default settings by using ATC 32U02C Thermostat or ACDU02C service tool with 17B0100N27 Harness. Use information in Table 5A to set CFM for your static.

Special Note for AHRI Testing: To achieve rated airflow for AHRI testing purposes on all PSC products TSM09 and 12 use high speed tap for heating and medium tap for cooling, all other models use high speed tap for both. When the heat pump has experienced less than 100 operational hours and the coil has not had sufficient time to be "seasoned", it is necessary to clean the coil with a mild surfactant such as Calgon to remove the oils left by manufacturing processes and enable the condensate to properly "sheet" off of the coil.

Figure 7: PSC Motor Speed Tap Selection

H for High speed tap
M for Medium speed tap
L for Low speed tap

Table 4

Thermostat		Unit		
Type	**Terminal**	**Factory Motor Connection**	**Board Connection**	
1 Stage	G	Med TAP	G	DXM2/ CXM
2 Stage Auto Speed Change	G Y2	Med TAP High TAP	G Y2	DXM2
			G BR2	CXM Relay
2 Speed Manual Change	G G2	Med TAP High TAP	G H	DXM2
			G BR2	CXM Relay

Blower Performance Data

Table 5: TSM with PSC Motor

Airflow in CFM with wet coil and clean 1" fiberglass air filter.

Size	Fan Speed	Rated CFM	Min CFM	External Static Pressure (in. wg)										
				0.00	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
09	High	400H/350C	284	425	415	400	380	360	330	320				
	Medium			360	345	325	320	300						
	Low			300										
12	High	500H/400C	310	520	490	460	440	420	400	375	330			
	Medium			345	330	325	320	310						
	Low			330	320	310	Operation not recommended							
15	High	600	416	689	672	664	652	642	633	618	605	590	568	539
	Medium			600	576	564	554	544	534	525	509	493	447	427
	Low			519	505	487	475	449	437	423				
18	High	685	480	685	674	664	653	640	627	612	594	575	553	528
	Medium			591	581	572	562	552	541	529	515	498	479	
	Low			514	503	492	482							
24	High	850	596	850	830	808	783	785	730	703	672	641	611	
	Medium			761	727	707	679	655	628	602				
	Low			653	630	610	594							
30	High	1000	798	1346	1310	1284	1221	1172	1135	1108	1069	1036	996	959
	Medium			1140	1113	1101	1077	1056	1030	1010	979	952	917	886
	Low			1008	980	968	949	934	914	897	870	846	810	
36	High	1200	882	1262	1234	1209	1180	1153	1122	1091	1057	1024	989	954
	Medium			1129	1107	1090	1068	1046	1020	996	965	935	901	
	Low			1010	995	980	962	940	938	916	893			

Units with CXM or DXM2 factory shipped on medium and HIGH TAPs. Field select other TAPs if needed.
All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.
All units AHRI/ISO/ASHRAE 13256-1 rated at CFM in table.
Airflow tolerance 7% with recommended supply air openings and sizes. (See SA Grille Table)

TSM Vertical Stack

Rev.:08/26/15

Table 5A: TSM Non Ducted ECM 88 and 80" Cabinets

Airflow in CFM with wet coil and clean 1" fiberglass air filter.

Tranquil-ity Model	ESP Range (in wg)	Range	Cooling Mode		Dehumid Mode		Heating Mode		Constant Fan Only Mode	Hi Fan Mode	Aux Emerg Mode
			Stg 2	Stg 1	Stg 2	Stg 1	Stg 2	Stg 1			
TSM09	0 to 0.25	Default	400	350	350	300	450	400	300	400	450
		Maximum	500	500	500	500	500	500	500	500	500
		Minimum	300	300	300	300	300	300	300	300	400
TSM12	0 to 0.25	Default	450	400	400	350	450	400	300	400	450
		Maximum	500	500	500	500	500	500	500	500	500
		Minimum	300	300	300	300	300	300	300	300	400
TSM15	0 to 0.3	Default	700	600	600	500	600	500	500	600	600
		Maximum	700	700	700	700	700	700	700	700	700
		Minimum	500	500	500	500	500	500	500	500	500
TSM18	0 to 0.3	Default	700	600	600	500	700	600	500	600	600
		Maximum	800	800	800	800	800	800	800	800	800
		Minimum	500	500	500	500	500	500	500	500	500
TSM24	0 to 0.3	Default	850	750	750	650	750	650	600	750	750
		Maximum	950	950	950	950	950	950	950	950	950
		Minimum	650	650	600	600	600	600	600	600	600
TSM30	0 to 0.4	Default	1100	1000	1000	900	1100	1000	700	850	1000
		Maximum	1100	1000	1100	900	1100	1100	1100	1100	1100
		Minimum	900	850	800	800	900	900	700	700	900
TSM36	0 to 0.4	Default	1200	1100	1100	1000	1200	1100	900	950	1350
		Maximum	1350	1350	1350	1350	1350	1350	1350	1350	1350
		Minimum	1100	1100	1100	1000	900	900	900	900	1000

All units AHRI/ISO/ASHRAE 13256-1 rated on CFM shown on performance data page.
Airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.
Shipped on default settings. C = Cooling; H = Heating; D = Dehumidification.
Change from default setting with service tool (ACDU02C) or Communicating thermostat (ATC32U01C).
Airflow is controlled within 7% up to the max ESP.
TRM15-36 ramp default is 30 seconds.

Electrical Wiring - Low Voltage

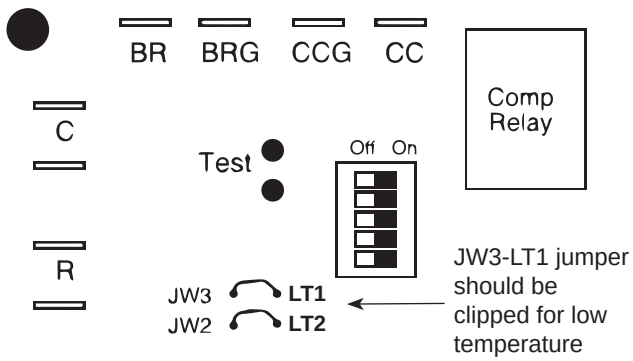
Thermostat Connections - The thermostat can be spliced or wired directly to the CXM or DXM board. See Unit Wire Diagram. Review the appropriate thermostat AOM (Application, Operation and Maintenance) manual.

Wall Sensors (ASW) for MPC or LON - Connections are made to DDC controller, see Unit Wire Diagram.

Low Water Temperature Cutout Selection - The CXM/DXM control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3, which changes the sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate and temperature is affecting the refrigeration circuit.

The factory setting for LT1 is for systems using water no lower than 50°F (10°C), boiler tower or open loop. Water temperature below 50°F (10°C) (extended range) applications must use antifreeze (most ground loops), jumper JW3 must be clipped as shown in Figure 8. Lowest refrigerant temperature, LT1 can sense without faulting off is, with LT1 unclipped - 30°F (-1°C) and clipped - 10°F (-12°C). All ClimateMaster units operating with entering water temperatures below 59°F [15°C] must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

Figure 8: LT1 Limit Setting



⚠ NOTICE! ⚠

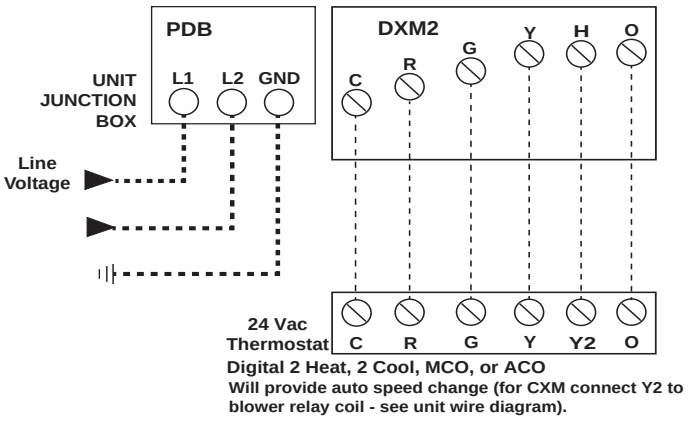
JW3 should never be clipped for equipment or systems without correct antifreeze mixture.

Thermostat Installation

Installation of Optional Wall-Mounted Thermostat - The unit can be furnished with a 24-volt surface mounted ACO or MCO control circuit or a remote 24-volt ACO or MCO thermostat. A typical field connection diagram is shown in Figure 9. Refer to instructions provided with remote thermostat for wiring instructions.

Low-voltage wiring between the unit and the wall thermostat must comply with all applicable electrical codes (i.e., NEC and local codes), and be completed before the unit is installed. Use of eight wire, color-coded, low-voltage cable is recommended.
Note: Your thermostat may require fewer than 8 connections, 8 wires allow future upgrading thermostat. Tape off unused wires.

Figure 9: Typical Field Connections for units with Wall-Mounted 24V Thermostat



⚠ WARNING! ⚠

WARNING! Disconnect electrical power source to prevent injury or death from electrical shock.

⚠ CAUTION! ⚠

CAUTION! Use copper conductors only to prevent **equipment** damage

Note: All customer-supplied wiring to be copper only, and must conform to NEC and local electrical codes. Wiring shown with dashed lines must be field-supplied and field-installed.

⚠ WARNING! ⚠

WARNING! Zone integrity must be maintained to efficiently control units or groups of units. Unless zones of control are considered and accounted for, adjacent units may operate in heating and cooling modes simultaneously.

Table 6 below lists recommended wire sizes and lengths to install the thermostat. The total resistance of low-voltage wiring must not exceed 1 ohm. Any resistance in excess of 1 ohm may cause the control to malfunction because of high voltage drop.

A91558 Series Thermostats have 6" (152) pigtail ending with 9-pin Molex. This allows an easy connection to either surface mount or remote with factory whip option.

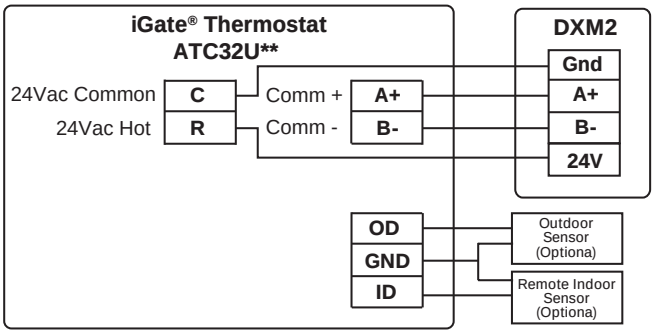
AT Series Thermostats have to be wired to screw terminals under the cover.

Table 6: Recommended Thermostat Wire Sizes

WIRE SIZE	MAX. WIRE LENGTH
22-Gauge	30 Feet
20-Gauge	50 Feet
18-Gauge	75 Feet
16-Gauge	125 Feet
14-Gauge	200 Feet

**Physical distance from thermostat to unit*

Figure 9a: Communicating Thermostat to DXM2



Chassis Pre-Installation

See Figures 10-13

1. Check chassis data plate. Verify chassis is correct for cabinet. Chassis I.D. sticker should match sticker on cabinet blower housing.
2. Remove compressor cover, check for any shipping or handling damage. Make repairs or adjustments.
   a. Verify refrigerant tubing is free of kinks or dents and that it does not touch other tubes or unit parts as it passes over or through. Adjust if needed and separate with closed cell insulation.
   b. Inspect insulation inside compressor enclosure for rubs from tubing or reversing valve. Adjust tubing or RV inward if needed. Be careful not to cause hit somewhere else.
3. Inspect all electrical connections. Connections must be clean and tight at the terminals.
4. Replace any panels or covers removed for steps 2-4.

The chassis is now ready for installation. Always keep chassis upright.

Figure 10

Figure 12

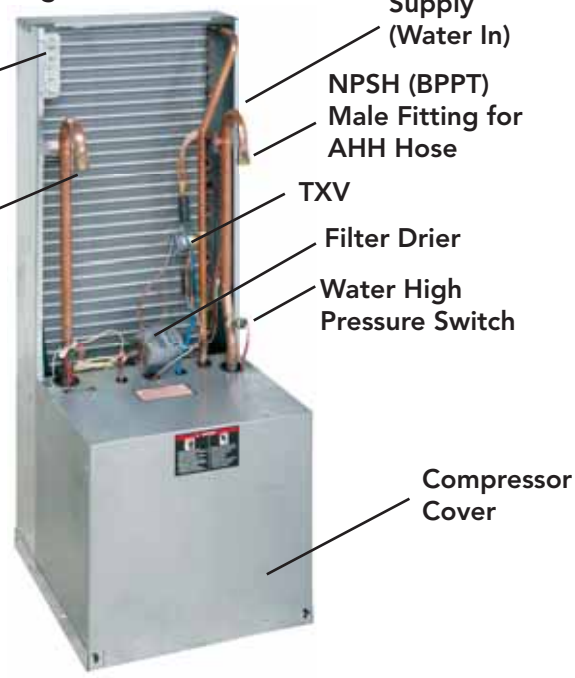
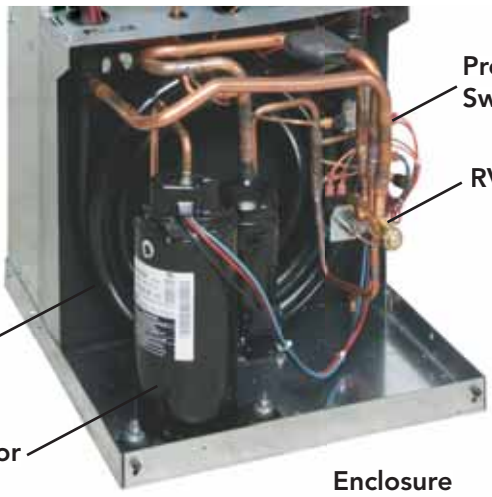


Figure 11

Figure 13

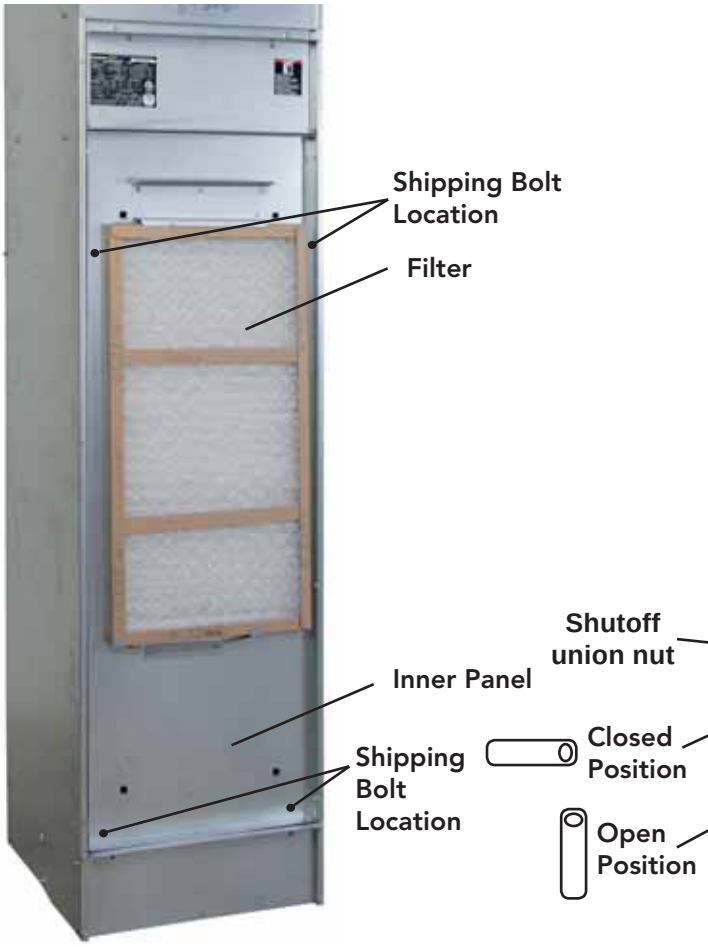


Hose Kit & Chassis Installation

Hose Kit and Chassis Installation - After cabinets are installed, and walls finished remove the filter and front blockoff panel. SAVE THESE FOR RE-INSTALLATION AFTER THE CHASSIS IS INSTALLED!

Step 1: Remove filter and inner panel. (Figure 14) For chassis shipped in cabinet – Remove and discard 4 shipping bolts.

Figure 14



Step 2: Attach the Flex Hoses to shutoffs in the cabinet. Unpack and examine hose kit. Remove all shipping and/or packing material such as rubber bands, plastic caps, and styrofoam. AHH Hose kit should contain (2) hoses.

⚠ CAUTION! ⚠

CAUTION! If the risers are under pressure, do not open shut off valves until installation is complete!

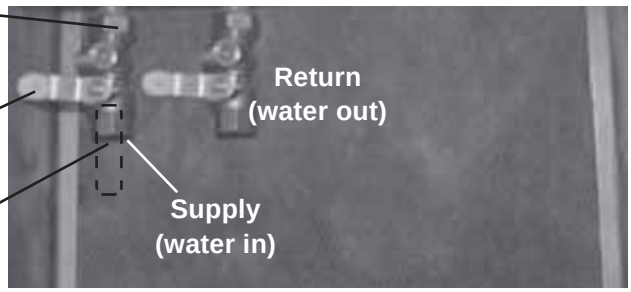
Figure 15

Apply Teflon tape to the male pipe thread end of each hose (Figure 15). When antifreeze is used in the loop, ensure the Teflon tape or pipe joint compound is compatible with the antifreeze type. Locate the 2 shutoff valves inside the unit cabinet (Figure 16). Supply (water in) is always closest to corner). Attach the hoses to the water valves with 2 crescent wrenches. Always use a back-up wrench when tightening the hose to the shutoff valve.

⚠ WARNING! ⚠

WARNING! Under no circumstances should any part of the hose itself be gripped or twisted by hand, pliers, channel locks or any other tool. Leakage or bursting may occur! Always use a back-up wrench when tightening the hose.

Figure 16



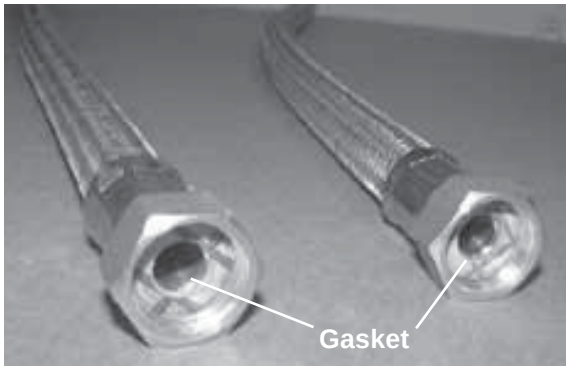
Cabinet (Style 2) Shutoff Location Shown

⚠ WARNING! ⚠

WARNING! Do Not Remove Valve or loosen valve union nut without first draining the risers below cabinet level. Check with contractor if risers have water.

Note: Make sure the valve handles are in a position that enables them to be fully opened and closed. Make sure shutoff union nut is tight. (Hand tight plus 1/4 turn - Do Not over tighten).

Figure 17



Step 3: Attach hoses to the Chassis. Check the swivel ends of the hoses (Figure 17). Gaskets must be in the hose for water tight connection. Slide the chassis part way into the cabinet. Match the WATER IN (supply) hose to the WATER IN tube on the chassis and the WATER OUT (Return) hose to the WATER OUT tube. Position hose toward chassis, use gentle loop- see bend radii Table 7. Hand tighten hose, using 2 crescent wrenches, tighten 1/8 to 1/4 turn.

Note: The rule of thumb for tightening the shutoff union nut and the hose union is hand tight plus 1/4 turn.

Table 7: Metal Hose Minimum Bend Radii

Hose Diameter	Minimum Bend Radii
1/2" (12.7)	2-1/2" (64)
3/4" (19.1)	4" (102)
1" (25.4)	5-1/2" (140)
1-1/4" (31.8)	6-3/4" (170)

Do not bend hoses at less than the minimum bend radius for the hose selected. Less than the minimum bend radius may cause the hose to collapse, which reduces water flow rate. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

⚠ CAUTION! ⚠

CAUTION! Do not bend or kink supply lines or hoses.

⚠ CAUTION! ⚠

CAUTION! Piping must comply with all applicable codes.

⚠ CAUTION! ⚠

CAUTION! Corrosive system water requires corrosion resistant fittings and hoses, and may require water treatment.

⚠ WARNING! ⚠

WARNING! Under no circumstances should any part of the hose itself be gripped or twisted by hand, pliers, channel locks or any other tool. Leakage or bursting may occur! Always use a back-up wrench when tightening the hose.

Step 4: Chassis Installation - Check condensate pan is free and on 4 rubber grommets.

Install the Chassis as follows:

1. Slide Chassis fully into cabinet. Check hose for kinks, do not allow less than minimum bend radius (see table 7), pull chassis partway out, loosen hose and reposition hose if needed, retighten.
2. Verify that both the shut-off valves are closed. See Fig. 16. (handle horizontal)
3. Verify riser stack has been pressure tested, and all leaks have been repaired.

⚠ WARNING! ⚠

WARNING! Do Not open valves to chassis until system has flushed and purged of air!

⚠ IMPORTANT! ⚠

IMPORTANT! After the system has been filled and system pump is started, all connections should be rechecked for water leaks. ClimateMaster WILL NOT be responsible or liable for damage caused by water leaks at any field water connections!

4. Flush system following the procedure in Preparation for Start-up Section of this manual.
5. When the system is clean and flushed, open both water shut off valves and check piping for leaks. Repair all leaks before continuing.
6. Complete electrical connections between cabinet and chassis. Connect wire harnesses hanging down from under side of control box to chassis connections. (See Figure18). Check that Molex connectors are snapped together, pull gently on connector - do not pull on wires.

Figure 18

7. Before installing the inner panel and filter, perform the following checks:
   a. Verify all pre-installation and installation steps were completed.
   b. Verify all copper tubes do not touch or rub other tubes or parts of the unit.
   c. Ensure that fan wheel rotates freely and does not rub against housing. If rough handling during shipping has caused fan wheel to shift, adjust as necessary.
   d. Verify that water piping connections to the chassis are complete and that unit service valves which were closed during flushing have been opened.
   e. Verify that power between the cabinet and chassis is properly connected.
   f. Assure that the unit drain is properly positioned, secured and not blocked.
   g. Verify that the nuts used to secure the blower assembly to the fan deck are tight.
   h. Check that chassis is fully inserted, front to back, side gap equal and chassis is centered in cabinet.
   i. After the system has been filled and system pump is started, all connections should be re-checked for water leaks. ClimateMaster WILL NOT be responsible or liable for damage caused by water leaks at any field water connections!
8. Re-attach the inner panel (8 screws) and filter as shown in Figure 19. Chassis must free float on condensate pan. If inner panel holes do not align, push chassis further in.
9. Install the cabinet return air panel after start up. See installation instructions shipped with return air/access panel for detailed information.

Figure 19

Start-Up Preparation

System Cleaning and Flushing - Cleaning and flushing the unit is the single most important step to ensure proper start-up and continued efficient operation of the system. Follow the instructions below to properly clean and flush the system: **Do not flush through TSM chassis**. Coax can get plugged and water flow will be reduced, causing poor performance and may cause LT1 sensor to trip.

⚠ WARNING! ⚠

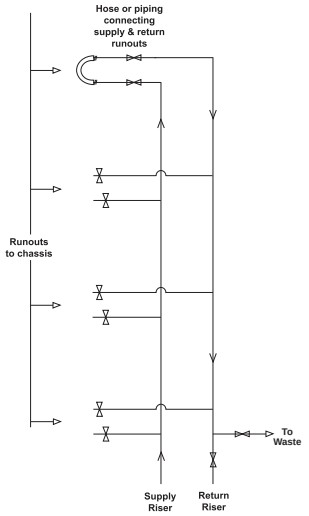
WARNING! To prevent injury or death due to electrical shock or contact with moving part, open unit disconnect before servicing unit.

1. Verify that electrical power to the unit is disconnected.
2. Verify that supply and return riser service valves are closed at each unit.
3. Fill the system with water. Bleed all air from the system but do not allow the system to over flow. Check the system for leaks and make any required repairs.
4. Adjust the water and air level in the expansion tank.
5. With strainers in place, (ClimateMaster recommends a strainer with a #20 stainless steel wire mesh) start the pumps. Systematically check that all of the air is bled from the system.
6. Verify that make-up water is available and adjusted to properly replace any space remaining when all air is evacuated. Check the system for leaks and make any additional repairs required.
7. Set the boiler to raise the loop temperature to approximately 85°F [29.4°C]. Open the drain at the lowest point in the system. Verify that make-up water replacement rate equals rate of bleed. Continue to bleed the system until the water appears clean or for at least three hours whichever is longer.
8. Completely drain the system.

Flush risers as follows: (Refer to Figure 20).

1. Remove cabinet filter and front inner panel. Save these for reinstallation after the chassis is installed.
2. Close shut-off valves at each cabinet on the riser except the shut-off valve on the top floor.
3. At the top floor, install the hose kit and connect the ends of the hoses with the factory riser flush adapter from AFL5751.
4. Flush solution through supply riser. Note: The solution passes through the top floor connection down the return riser.
5. When the building has more than 10 floors, connect the supply and return runouts on the top two floors to divide the water flow and reduce pressure drop at the pump.
6. Repeat flushing procedure for each set of risers in the building.
7. Refill the system and add in a proportion of trisodium phosphate approximately one pound per 150 gallons [0.4kg per 500 liters] of water. Reset the boiler to raise the loop temperature to about 100°F [37.8°C].
8. Circulate the solution for between 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
9. Open the supply and return riser service valves at each unit. Refill the system and bleed off all air.
10. Units with internal pumps, to prevent cavitation and pump failure, air must be bleed from both sides of pump. First close off supply and open return shutoff. Open air bleed downstream of pump, bleed air, next close return and open supply shutoff, bleed air. Close air bleed.
11. Test the system pH with litmus paper. The system water should have a pH of 6 to 8.5. Add chemicals as appropriate to maintain pH levels.
12. When the system is successfully cleaned, flushed, refilled, and bled, check the main system panels, safety cutouts, and alarms. Set controls to properly maintain loop temperature.

Figure 20: Typical piping arrangement for flushing risers.



⚠ CAUTION! ⚠

CAUTION! Do Not use "Stop-Leak" or any similar chemical agent in this system. Addition of these chemicals to the loop water can foul the system and can inhibit unit operation.

⚠ CAUTION! ⚠

CAUTION! To avoid possible damage to piping systems constructed of plastic piping, DO NOT allow loop temperature to exceed 110°F [43.3°C].

TSM Vertical Stack

Rev.:08/26/15

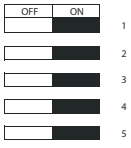
TSM Series Wiring Diagram Matrix

All current diagrams can be located online at climatemaster.com. Click 'Commercial' (go to 'Quick Links' in the upper right) using the part numbers presented below.

Model	Refrigerant	Wiring Diagram Part Number	Electrical	Control		Agency
TSM/TSL CHASSIS						
09-36 PSC	410A	96B0173N33	230/208/60/1; 265/60/1	CXM	STANDARD THERMOSTAT	ETL
09-18 PSC; RIB		96B0173N33		CXM	STANDARD THERMOSTAT	
09-36 PSC		96B0173N32		DXM2	STANDARD THERMOSTAT	
09-18 PSC; RIB		96B0173N32		DXM2	STANDARD THERMOSTAT	
09-12 ECM		96B0173N34		DXM2	STANDARD THERMOSTAT	
09-12 ECM; RIB		96B0173N34		DXM2	STANDARD THERMOSTAT	
15-36 ECM		96B0173N35		DXM2	STANDARD THERMOSTAT	
15-18 ECM; RIB		96B0173N35		DXM2	STANDARD THERMOSTAT	
09-36 PSC		96B0173N62		DXM2	COMMUNICATING THERMOSTAT	
09-18 PSC; RIB		96B0173N62		DXM2	COMMUNICATING THERMOSTAT	
09-12 ECM		96B0173N64		DXM2	COMMUNICATING THERMOSTAT	
09-12 ECM; RIB		96B0173N64		DXM2	COMMUNICATING THERMOSTAT	
15-36 ECM		96B0173N65		DXM2	COMMUNICATING THERMOSTAT	
15-18 ECM; RIB		96B0173N65		DXM2	COMMUNICATING THERMOSTAT	
TSM/TSL CABINET						
09-36 PSC	410A	96B0135N07	230/208/60/1; 265/60/1	CXM/DXM2	SURFACE MOUNT THERMOSTAT	ETL
09-12 ECM		96B0135N08		CXM/DXM2	SURFACE MOUNT THERMOSTAT	
15-36 ECM		96B0135N09		CXM/DXM2	SURFACE MOUNT THERMOSTAT	
09-36 PSC		96B0135N01		CXM/DXM2	REMOTE THERMOSTST	
09-12 ECM		96B0135N02		CXM/DXM2	REMOTE THERMOSTST	
15-36 ECM		96B0135N03		CXM/DXM2	REMOTE THERMOSTST	
09-36 PSC		96B0135N04		CXM/DXM2	ADA	
09-12 ECM		96B0135N05		CXM/DXM2	ADA	
15-36 ECM		96B0135N06		CXM/DXM2	ADA	
TSM/TSL CABINET AUX MPC/LON						
09-36 PSC; MPC	410A	96B0135N21	230/208/60/1; 265/60/1	CXM/DXM2	WALL SENSOR	ETL
09-12 ECM; MPC		96B0135N22		CXM/DXM2	WALL SENSOR	
15-36 ECM; MPC		96B0135N23		CXM/DXM2	WALL SENSOR	
09-36 PSC; LON		96B0135N11		CXM/DXM2	WALL SENSOR	
09-12 ECM; LON		96B0135N12		CXM/DXM2	WALL SENSOR	
15-36 ECM; LON		96B0135N13		CXM/DXM2	WALL SENSOR	

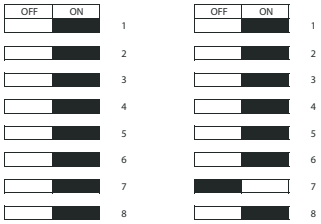
DIP Setting Table

TSM DIGIT 8 = F,Q + CXM Standard



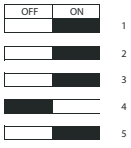
S1

TSM DIGIT 8 = K,G + DXM Standard



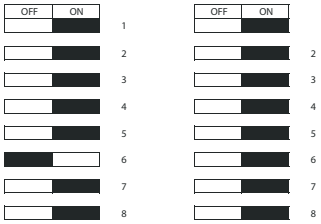
S1 S2

TSM DIGIT 8 = H,T + CXM w/LON or MPC



S1

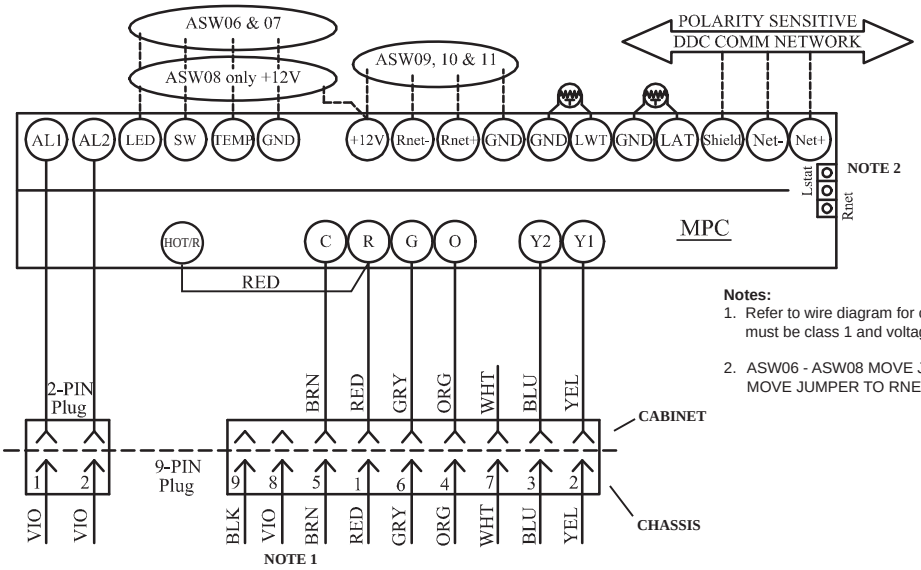
TSM DIGIT 8 = V,U + DXM w/LON or MPC



S1 S2

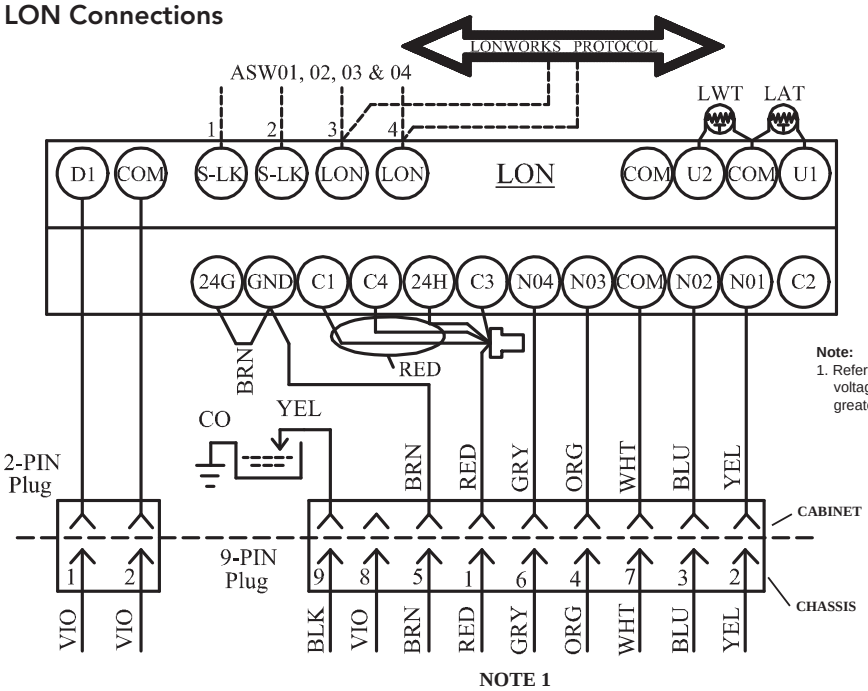
Connections to DDC Options

MPC Connections



Notes:
1. Refer to wire diagram for connection to CXM/DXM. Low voltage wiring must be class 1 and voltage rated equal or greater than unit supply voltage.
2. ASW06 - ASW08 MOVE JUMPER TO LSTAT, ASW09 - ASW11 MOVE JUMPER TO RNET.

LON Connections

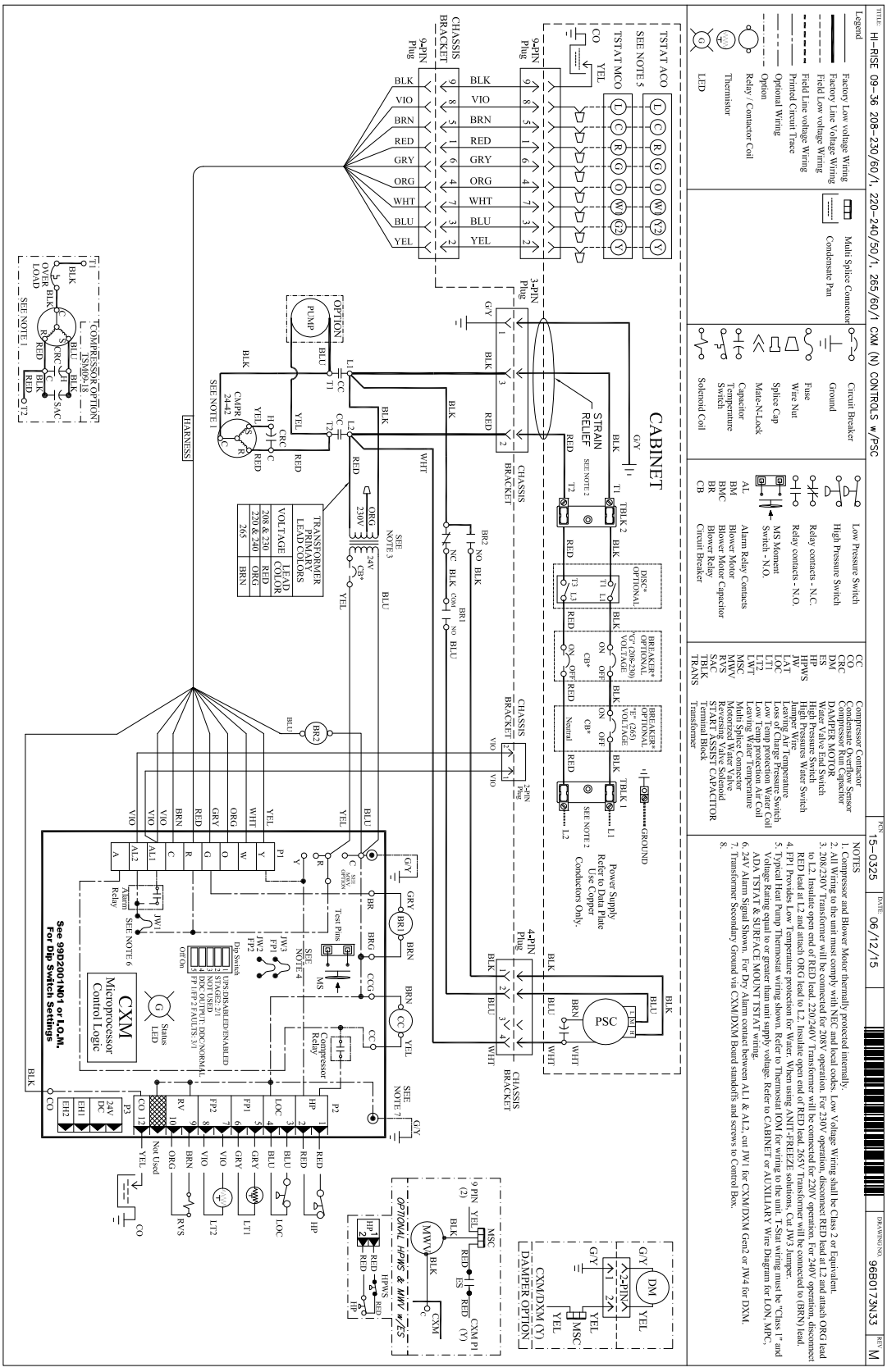


Note:
1. Refer to wire diagram for connection to CXM/DXM. Low voltage wiring must be class 1 and voltage rated equal or greater than unit supply voltage.

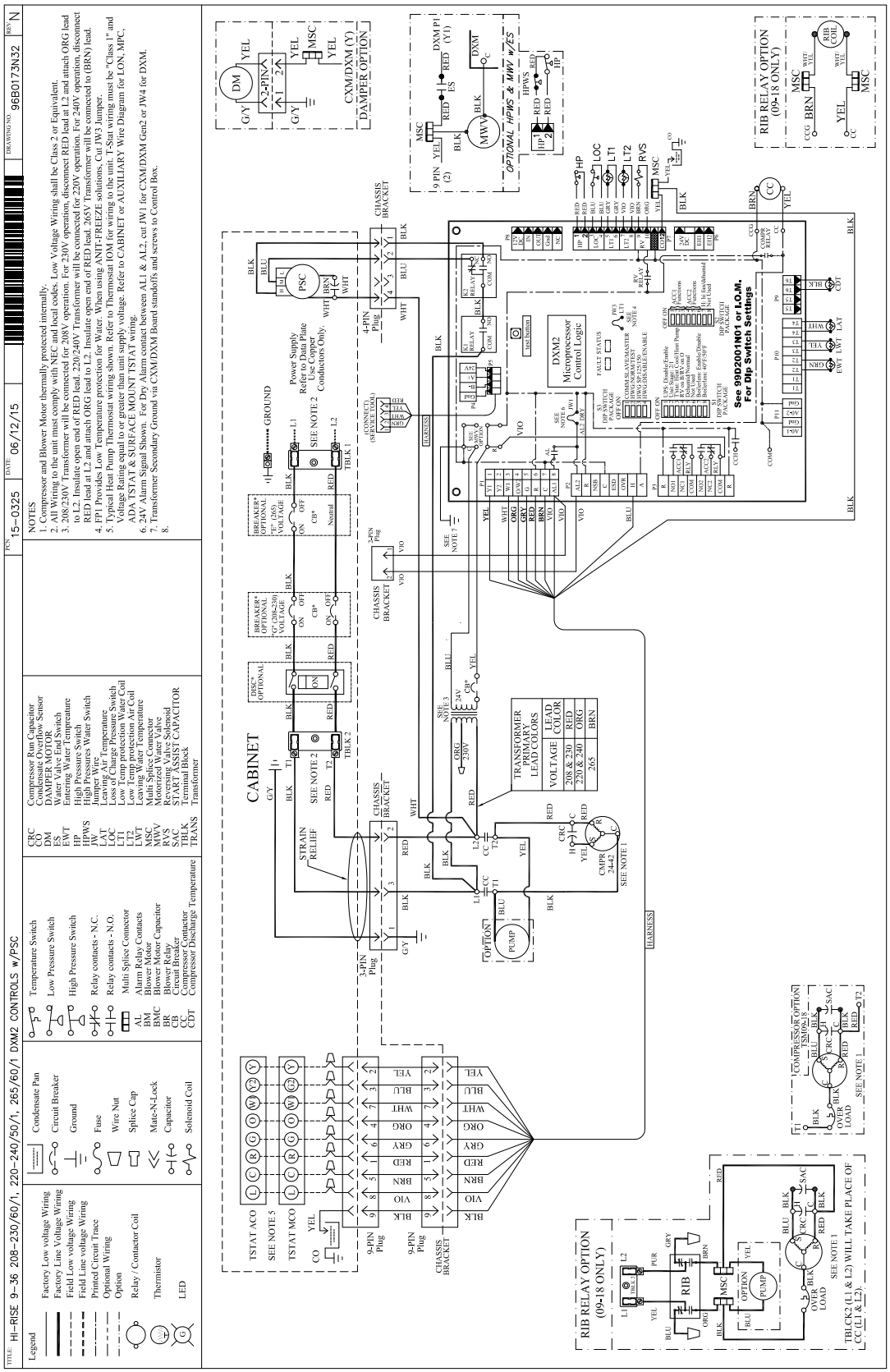
TSM Vertical Stack

Rev.:08/26/15

Typical Wiring Diagram
TSM 09 - 36 Units with PSC Motor and CXM



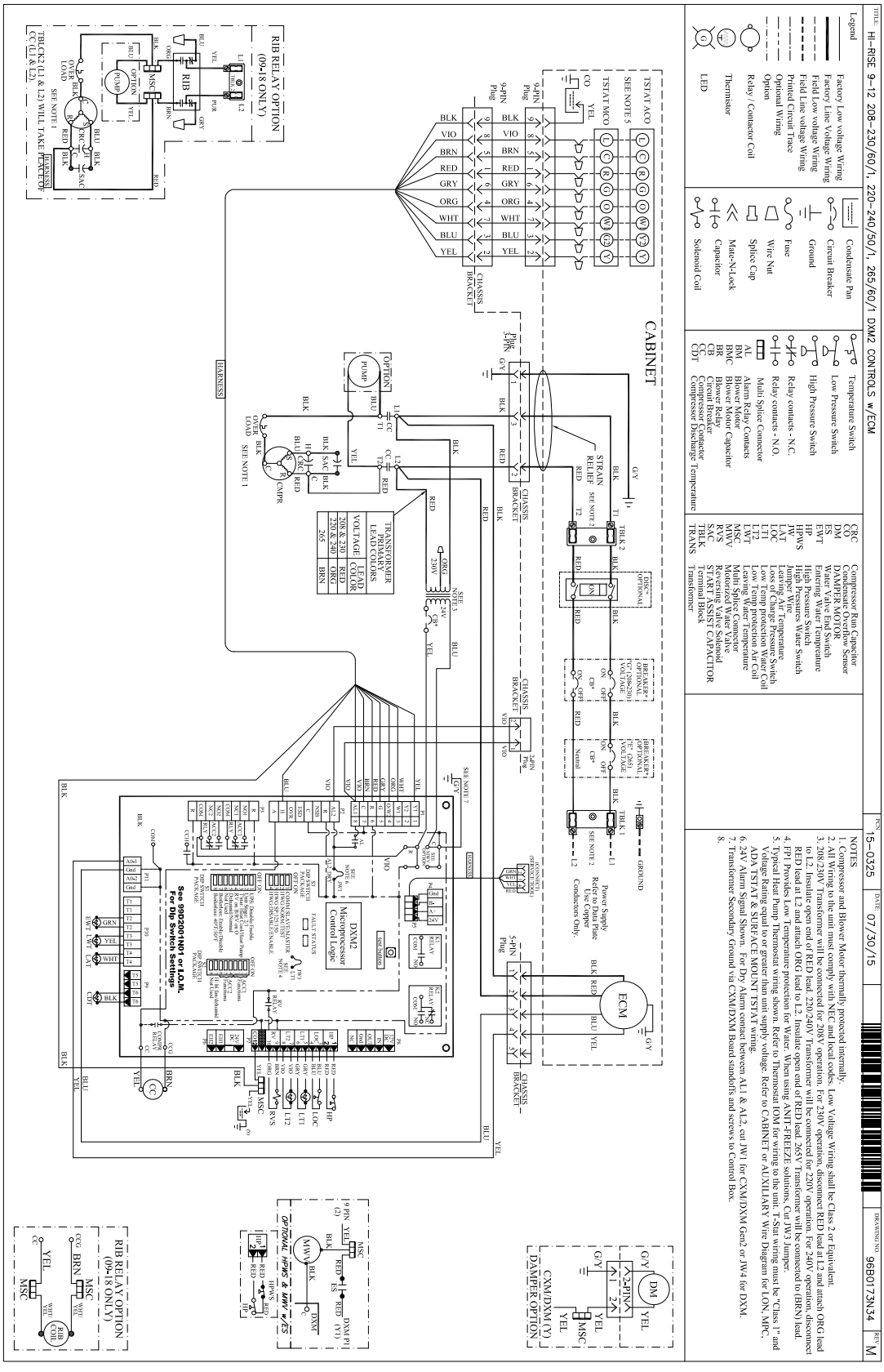
Typical Wiring Diagram
TSM 09 - 36 Units with PSC Motor and DXM2



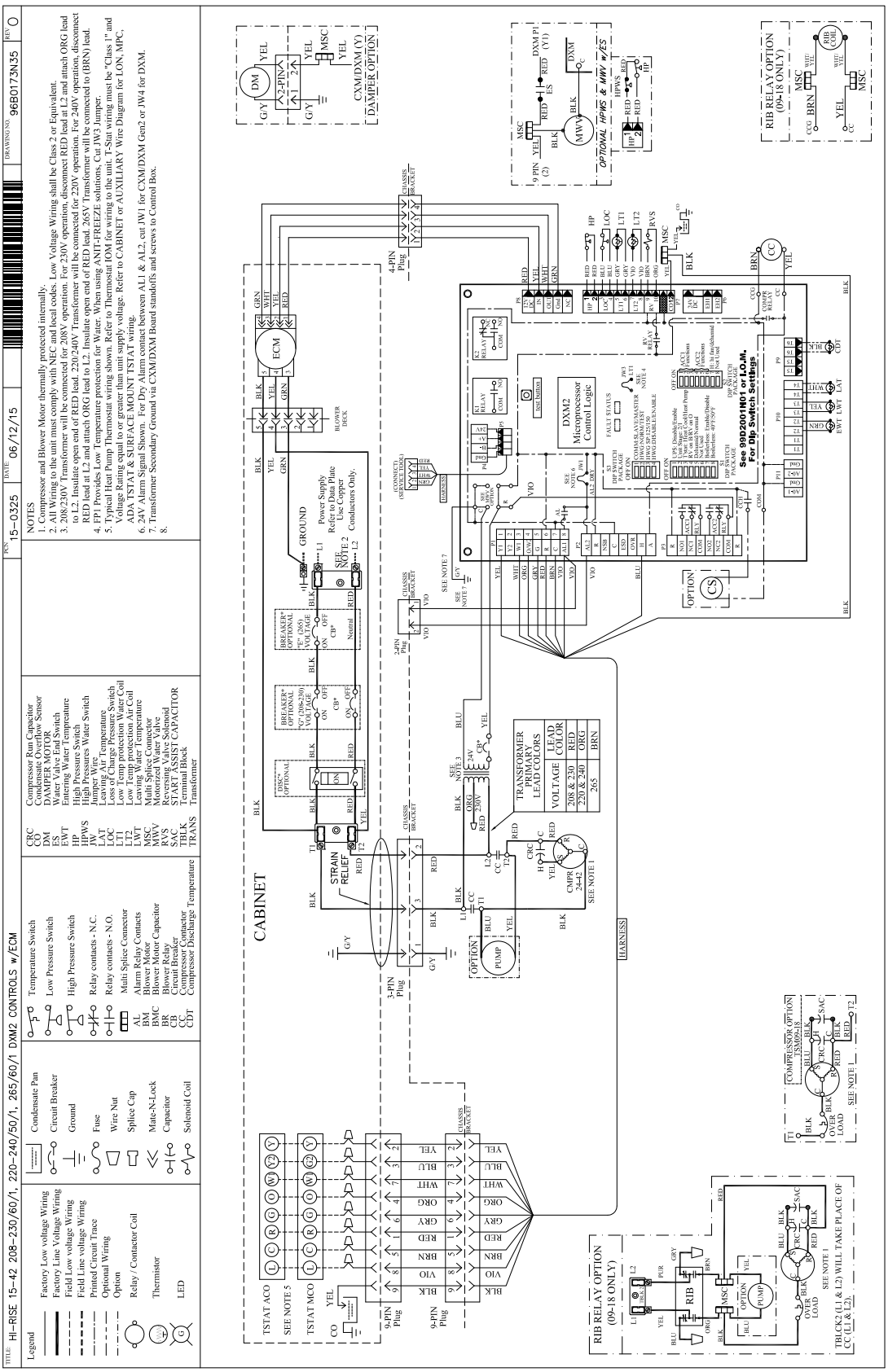
TSM Vertical Stack

Rev.:08/26/15

Typical Wiring Diagram
TSM 09 - 12 Units with ECM Motor and DXM2


TITLE: HI-RISE 9-12 208-230/60/1, 220-240/50/1, 265/60/1 DXM2 CONTROLS w/ECM
REV: 15-0325
DATE: 07/30/15
DRAWING NO: 96B0173N34
REV: M
NOTES
1. Compressor and Blower Motor thermally protected internally.
2. All Wiring to the unit must comply with NEC and local codes. Low Voltage Wiring shall be Class 2 or Equivalent.
3. 24V Transformer is factory connected for 230V operation. To connect for 208V operation, disconnect RED lead at T2 and attach ORG lead to T1. For 265V Transformer change RED lead 230/240V Transformer will be connected to ORG lead. For 265V Transformer change RED lead at T2 and attach ORG lead to L2. Insulate unused end of RED lead. 265V Transformer will be connected to BRN lead.
4. FP1 Provides Low Temperature protection for Water When using ANTI-FREEZE solutions. Cut JW3 Jumper.
5. Typical Heat Pump Thermostat wiring shown. Refer to Thermostat IOM for wiring to the unit. T-Stat wiring must be "Class 1" and Voltage Rating equal to or greater than unit supply voltage. Refer to CABINET or AUXILIARY Wire Diagram for LON, MPC, ADA TSTAT & SURFACE MOUNT TSTAT wiring.
6. 24V Alarm Signal Shown. For Dry Alarm contact between AL1 & AL2, cut JW1 for CXM/DXM Gen2 or JW4 for DXM.
7. Transformer Secondary Ground via CXM/DXM Board standoffs and screws to Control Box.
8.
Legend
Factory Low voltage Wiring
Factory Line Voltage Wiring
Field Low voltage Wiring
Field Line voltage Wiring
Printed Circuit Trace
Optional Wiring
Option
Relay / Contactor Coil
Thermistor
LED
Condensate Pan
Circuit Breaker
Ground
Fuse
Wire Nut
Splice Cap
Mate-N-Lock
Capacitor
Solenoid Coil
Temperature Switch
Low Pressure Switch
High Pressure Switch
Relay contacts - N.C.
Relay contacts - N.O.
Multi Splice Connector
Alarm Relay Contacts
Blower Motor
Blower Motor Capacitor
Blower Relay
Circuit Breaker
Compressor Contactor
Compressor Discharge Temperature
Compressor Run Capacitor
Condensate Overflow Sensor
DAMPER MOTOR
Water Valve End Switch
Entering Water Temperature
High Pressure Switch
HPWS High Pressure Switch
JW Jumper Wire
LAT Leaving Air Temperature
LOC Loss of Charge Pressure Switch
LT1 Low Temp protection Air Coil
LT2 Low Temp protection Water Coil
LWT Leaving Water Temperature
MSC Multi Splice Connector
RVS Reversing Valve Solenoid
SAC START ASSIST CAPACITOR
TBLK Terminal Block
TRANS Transformer
CABINET
TSTAT ACO
SEE NOTE 5
TSTAT MCO
9-PIN Plug
CHASSIS BRACKET
RIB RELAY OPTION (09-18 ONLY)
TB/LGC (L1 & L2) WILL TAKE PLACE OF HARNESS
HARNESS
PUMP
OPTION
OVER LOAD
SEE NOTE 1
CMPR
TRANSFORMER PRIMARY LEAD COLORS
VOLTAGE / COLOR
208 & 230 / RED
220 & 240 / ORG
265 / BRN
SEE NOTE 3
STRAIN RELIEF
SEE NOTE 2
TBLK 2
TBLK 1
L1
L2
GROUND
Power Supply Refer to Data Plate Use Copper Conductors Only.
ECM
5-PIN Plug
DXM2 Microprocessor Control Logic
See 96B2001N01 or I.O.M. For Dip Switch Settings
DIP SWITCH PACKAGE
FAULT STATUS
LED
SEE NOTE 4
JW3
JW4
JW2
JW1
RELAY
CXM/DXM (Y) DAMPER OPTION
DM
3-PIN
MSC
DXM P1 (Y1)
9 PIN (2)
DXM
RIB RELAY OPTION (09-18 ONLY)
BRN
YEL
WHT
BLK
RED
GRY
ORG
VIO
BLU
GRN
PUR

Typical Wiring Diagram
TSM 15 - 36 Units with ECM Motor and DXM2



CXM Control

CXM Control - For detailed control information, see CXM Application, Operation and Maintenance (AOM) manual (part # 97B0003N12).

Field Selectable Inputs - Test mode: Test mode allows the service technician to check the operation of the control in a timely manner. At board, momentarily shorting the test terminals or externally, momentarily push test button (See Fig 10), the CXM control enters a 20 minute test mode period in which all time delays are sped up 15 times. Upon entering test mode, the status LED will flash a code representing the last fault. For diagnostic ease at the thermostat, the alarm relay will also cycle during test mode. The alarm relay will cycle on and off similar to the status LED to indicate a code representing the last fault, at the thermostat. Test mode can be exited by shorting the test terminals or holding button for 3 seconds.
Retry Mode: If the control is attempting a retry of a fault, the status LED will slow flash (slow flash = one flash every 2 seconds) to indicate the control is in the process of retrying.

Field Configuration Options - Note: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the CXM control.

Water coil low temperature limit setting: Jumper 3 (JW3-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).
Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C].
Air coil low temperature limit setting: Jumper 2 (JW2-LT2 Low Temp) provides field selection of temperature limit setting for LT2 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature). **Note: This jumper should only be clipped under extenuating circumstances, as recommended by the factory.**
Not Clipped = 30°F [-1°C]. Clipped = 10°F [-12°C].
Alarm relay setting: Jumper 1 (JW1-AL2 Dry) provides field selection of the alarm relay terminal AL2 to be jumpered to 24VAC or to be a dry contact (no connection).
Not Clipped = AL2 connected to R. Clipped = AL2 dry contact (no connection).

DIP Switches - Note: In the following field configuration options, DIP switches should only be changed when power is removed from the CXM control.

DIP switch 1: Unit Performance Sentinel Disable **-** provides field selection to disable the UPS feature.
On = Enabled. Off = Disabled.
DIP switch 2: Stage 2 Selection - provides selection of whether compressor has an "on" delay. If set to stage 2, the compressor will have a 3 second delay before energizing. Also, if set for stage 2, the alarm relay will NOT cycle during test mode.
On = Stage 1. Off = Stage 2
DIP switch 3: Not Used.
DIP switch 4**:** DDC Output at EH2 - provides selection for DDC operation. If set to "DDC Output at EH2," the EH2 terminal will continuously output the last fault code of the controller. If set to "EH2 normal," EH2 will operate as standard electric heat output.
On = EH2 Normal. Off = DDC Output at EH2.
Note: Some CXM controls only have a 2 position DIP switch package. If this is the case, this option can be selected by clipping the jumper which is in position 4 of SW1.
Jumper not clipped = EH2 Normal. Jumper clipped = DDC Output at EH2.
DIP switch 5: Factory Setting - Normal position is "On." Do not change selection unless instructed to do so by the factory.

Table 9: LED And Alarm Relay Operations

Description of Operation	LED	Alarm
Normal Mode	ON	Open
Normal Mode w/UPS Warning	ON	Cycle (Closed 5 seconds, Open 25 seconds)
CXM is non-functional	OFF	Open
Fault Retry	Slow Flash	Open
Lockout	Fast Flash	Closed
Over/Under Voltage Shutdown	Slow Flash	Open (Closed after 15 Minutes)
Test Mode - No Fault in Memory	Flashing Code 1	Cycling Code 1
Test Mode - HP Fault in Memory	Flashing Code 2	Cycling Code 2
Test Mode - LP Fault in Memory	Flashing Code 3	Cycling Code 3
Test Mode - LT1 Fault in Memory	Flashing Code 4	Cycling Code 4
Test Mode - LT2 Fault in Memory	Flashing Code 5	Cycling Code 5
Test Mode - CO Fault in Memory	Flashing Code 6	Cycling Code 6
Test Mode - Over/Under Shutdown in Memory	Flashing Code 7	Cycling Code 7
Test Mode - UPS in Memory	Flashing Code 8	Cycling Code 8
Test Mode - Swapped Thermistor	Flashing Code 9	Cycling Code 9

-Slow Flash = 1 flash every 2 seconds
-Fast Flash = 2 flashes every 1 second
-Flash code 2 = 2 quick flashes, 10 second pause, 2 quick flashes, 10 second pause, etc.
-On pulse 1/3 second; off pulse 1/3 second

DXM2 Control

DXM2 Control - For detailed control information, see DXM AOM (part #97B0003N15), Lon controller AOM (part #97B0013N01) or MPC AOM (part # 97B0031N01).

Table 10: LED And Alarm Relay Output Table

DMX2 CONTROLLER FAULT CODES			
DMX2 Fault and Status LED Operation with Test Mode Not Active	**Fault LED (Red)**	**Status LED (Green)**	**Alarm Relay**
DXM2 Is Non-Functional	Off	Off	Open
Normal Operation - No Active Communications	On	On	Open
Normal Operation - With Active Communications	Very Slow Flash	ON	Open
Control Is Currently In Fault Retry Mode	Slow Flash	-	Open
Control Is Currently Locked Out	Fast Flash	-	Closed
Control Is Currently In An Over/ Under Voltage Condition	Slow Flash	-	Open (Closed After 15 min)
Hot Water Mode Active	-	Slow Flash	Open
(NSB) Night Setback Condition Recognized	-	Flashing Code 2	-
(ESD) Emergency Shutdown Condition Recognized	-	Flashing Code 3	-
Invalid Thermostat Input Combination	-	Flashing Code 4	-
High Hot Water Temperature Lockout Active	-	Flashing Code 5	-
Hot Water Mode Sensor Fault Active	-	Flashing Code 6	-
DMX2 Fault LED and Status Operation with Test Mode Active	**Fault LED (Red)**	**Status LED (Green)**	**Alarm Relay**
No Fault Since Power Up In Memory	Flashing Code 1	-	Cycling Code 1
High Pressure Fault In Memory	Flashing Code 2	-	Cycling Code 2
Low Pressure Fault In Memory	Flashing Code 3	-	Cycling Code 3
Low Temperature Protection 1 In Fault Memory	Flashing Code 4	-	Cycling Code 4
Low Temperature Protection 2 In Fault Memory	Flashing Code 5	-	Cycling Code 5
Condensate Overflow Fault In Memory	Flashing Code 6	-	Cycling Code 6
Over/Under Voltage Shutdown In Memory	Flashing Code 7	-	Cycling Code 7
UPS Warning In Memory	Flashing Code 8	-	Cycling Code 8
UPT Fault In Memory	Flashing Code 9	-	Cycling Code 9
ECM Air Flow Fault In Memory	Flashing Code 10	-	Cycling Code 10
Test Mode Active With No ECM Connected Or Operating	-	Fast Flash	-
Test Mode Active With ECM Operating	-	Flashing ECM Airflow	-

- Fast Flash = 2 flashes every 1 second.
- Slow Flash = 1 flash every 2 seconds.
- Very Slow Flash = 1 flash every 5 seconds.
- Numeric Codes = On pulse 1/3 second; Off pulse 1/3 second followed by a 10 second delay.
- ECM Airflow = 1 flash per 100 CFM; On pulse 1/3 second followed by a 10 second delay.
- Alarm Relay Open = alarm signal off; Alarm Relay Closed = alarm signal on.

Field Configuration Options - Note: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the DXM 2 control.

Water coil low temperature limit setting: Jumper 3 (JW3-LT1 Low Temp) provides field selection of temperature limit setting for LT1 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).
Not Clipped = 30°F [-1°C].
Clipped = 10°F [-12°C].
Air coil low temperature limit setting: Jumper 2 (JW2-LT2 Low Temp) provides field selection of temperature limit setting for LT2 of 30°F or 10°F [-1°F or -12°C] (refrigerant temperature).
Note: This jumper should only be clipped under extenuating circumstances, as recommended by ClimateMaster technical services.
Not Clipped = 30°F [-1°C].
Clipped = 10°F [-12°C].
Alarm relay setting: Jumper 4 (JW4-AL2 Dry) provides field selection of the alarm relay terminal AL2 to be jumpered to 24VAC or to be a dry contact (no connection).
Not Clipped = AL2 connected to R.
Clipped = AL2 dry contact (no connection).
Low pressure normally open: Jumper 1 (JW1-LP norm open) provides field selection for low pressure input to be normally closed or normally open.
Not Clipped = LP normally closed. Clipped = LP normally open.
ECM Motor Option Jumpers (Set at Factory):
For TSM09 and 12 switch ECM motor set AO-1 jumper to PWM.

Field Selectable Inputs - Test mode: Test mode allows the service technician to check the operation of the control in a timely manner, at the board, by pushing test button, or externally, with service tool using harness 11B0100N27 connected to port (See Fig 15). The DXM 2 control enters a 20 minute test mode period in which all time delays are sped up 15 times. Upon entering test mode, the status LED will flash a code representing the last fault. For diagnostic ease at the thermostat, the alarm relay will also cycle during test mode. The alarm relay will cycle on and off similar to the status LED to indicate a code representing the last fault, at the thermostat. Test mode can be exited by holding test button on board for 3 seconds or service tool.
Retry mode: If the control is attempting a retry of a fault, the status LED will slow flash (slow flash = one flash every 2 seconds) to indicate the control is in the process of retrying.

DIP Switches - Note: In the following field configuration options, DIP switches should only be changed when power is removed from the DXM control.

DIP Package #1 (S1) - DIP Package #1 has 8 switches and provides the following setup selections:
1.1 - Unit Performance Sentinel (UPS) disable: DIP Switch 1.1 provides field selection to disable the UPS feature.

On = Enabled. Off = Disabled.
1.2 - Compressor relay staging operation: DIP 1.2 provides selection of compressor relay staging operation. The compressor relay can be selected to turn on with a stage 1 or stage 2 call from the thermostat. This is used with dual stage units (2 compressors where 2 DXM 2 controls are being used) or with master/slave applications. In master/slave applications, each compressor and fan will stage according to its appropriate DIP 1.2 setting. If set to stage 2, the compressor will have a 3 second on-delay before energizing during a Stage 2 demand. Also, if set for stage 2, the alarm relay will NOT cycle during test mode.
On = Stage 1. Off = Stage 2.
1.3 - Thermostat type (heat pump or heat/cool): DIP 1.3 provides selection of thermostat type. Heat pump or heat/cool thermostats can be selected. When in heat/cool mode, Y1 is the input call for cooling stage 1; Y2 is the input call for cooling stage 2; W1 is the input call for heating stage 1; and O/W2 is the input call for heating stage 2. In heat pump mode, Y1 is the input call for compressor stage 1; Y2 is the input call for compressor stage 2; W1 is the input call for heating stage 3 or emergency heat; and O/W2 is the input call for reversing valve (heating or cooling, depending upon DIP 1.4).
On = Heat Pump. Off = Heat/Cool.
1.4 - Thermostat type (O/B): DIP 1.4 provides selection of thermostat type for reversing valve activation. Heat pump thermostats with "O" output (reversing valve energized for cooling) or "B" output (reversing valve energized for heating) can be selected with DIP 1.4.
On = HP stat with "O" output for cooling. Off = HP stat with "B" output for heating.
1.5 - Dehumidification mode: DIP 1.5 provides selection of normal or dehumidification fan mode. In dehumidification mode, the fan speed relay will remain off during cooling stage 2. In normal mode, the fan speed relay will turn on during cooling stage 2.
On = Normal fan mode. Off = Dehumidification mode.
1.6 - DDC output at EH2: DIP 1.6 provides selection for DDC operation. If set to "DDC Output at EH2," the EH2 terminal will continuously output the last fault code of the controller. If set to "EH2 normal," EH2 will operate as standard electric heat output.
On = EH2 Normal. Off = DDC Output at EH2.
1.7 - Boilerless operation: DIP 1.7 provides selection of boilerless operation. In boilerless mode, the compressor is only used for heating when LT1 is above the temperature specified by the setting of DIP 1.8. Below DIP 1.8 setting, the compressor is not used and the control goes into emergency heat mode, staging on EH1 and EH2 to provide heating.
On = normal. Off = Boilerless operation.
1.8 - Boilerless changeover temperature: DIP 1.8 provides selection of boilerless changeover temperature setpoint. Note that the LT1 thermistor is sensing refrigerant temperature between the coaxial heat exchanger and the expansion device (TXV). Therefore, the 50°F [10°C] setting is not 50°F [10°C] water, but approximately 60°F [16°C] EWT.
On = 50°F [10°C]. Off = 40°F [16°C].

DIP Package #2 (S2) - DIP Package #2 has 8 switches and provides the following setup selections:
2.1 - Accessory1 relay personality: DIP 2.1 provides selection of ACC1 relay personality (relay operation/characteristics). See table 9 for description of functionality.
2.2 - Accessory1 relay personality: DIP 2.2 provides selection of ACC 1 relay personality (relay operation/characteristics). See table 9 for description of functionality.
2.3 - Accessory1 relay personality: DIP 2.3 provides selection of ACC 1 relay options. See table 11 for description of functionality.
2.4 - Accessory2 relay personality: DIP 2.4 provides selection of ACC 2 relay personality (relay operation/characteristics). See table9 for description of functionality.
2.5 - Accessory2 relay personality: DIP 2.5 provides selection of ACC 2 relay personality (relay operation/characteristics). See table 9 for description of functionality.
2.6 - Accessory2 relay personality: DIP 2.6 provides selection of ACC 2 relay options. See table 9 for description of functionality.

Table 8: Accessory DIP Switch Settings

DIP 2.1	DIP 2.2	DIP 2.3	ACC1 Relay Option
On	On	On	Cycle with fan
Off	On	On	Digital NSB
On	Off	On	Water Valve - slow opening
On	On	Off	OAD
Off	Off	Off	Reheat Option - Humidistat
Off	On	Off	Reheat Option - Dehumidistat
DIP 2.4	**DIP 2.5**	**DIP 2.6**	**ACC2 Relay Option**
On	On	On	Cycle with compressor
Off	On	On	Digital NSB
On	Off	On	Water Valve - slow opening
On	On	Off	OAD

All other DIP combinations are invalid

DIP Package #3 (S3) - Currently not used for TSM.

2.7 - Auto dehumidification fan mode or high fan mode: DIP 2.7 provides selection of auto dehumidification fan mode or high fan mode. In auto dehumidification mode, the fan speed relay will remain off during cooling stage 2 IF the H input is active. In high fan mode, the fan enable and fan speed relays will turn on when the H input is active.
On = Auto dehumidification mode. Off = High fan mode.
2.8 - Special factory selection: DIP 2.8 provides special factory selection. Normal position is "On". Do not change selection unless instructed to do so by the factory.

Safety Features - CXM/DXM2 Controls

Safety Features – CXM/DXM 2 Control
The safety features below are provided to protect the compressor, heat exchangers, wiring and other components from damage caused by operation outside of design conditions.
Anti-short cycle protection: The control features a 5 minute anti-short cycle protection for the compressor. Note: The 5 minute anti-short cycle also occurs at power up.
Random start: The control features a random start upon power up of 5-80 seconds.
Fault Retry: In Fault Retry mode, the Status LED begins slowly flashing to signal that the control is trying to recover from a fault input. The control will stage off the outputs and then "try again" to satisfy the thermostat input call. Once the thermostat input call is satisfied, the control will continue on as if no fault occurred. If 3 consecutive faults occur without satisfying the thermostat input call, the control will go into "lockout" mode. The last fault causing the lockout will be stored in memory and can be viewed at the "fault" LED (DXM board) or by going into test mode (CXM board). Note: LT1/LT2 faults are factory set at only one try.
Lockout: In lockout mode, the status LED will begin fast flashing. The compressor relay is turned off immediately. Lockout mode can be "soft" reset by turning off the thermostat (or satisfying the call). A "soft" reset keeps the fault in memory but resets the control. A "hard" reset (disconnecting power to the control) resets the control and erases fault memory.
Lockout with emergency heat: While in lockout mode, if W becomes active (CXM), emergency heat mode will occur. If DXM 2 is configured for heat pump thermostat type (DIP 1.3), emergency heat will become active if O/W2 is energized.

For LED fault codes and alarm relay output for CXM see table 9 and DXM 2 see table 10.
High pressure switch: When the high pressure switch opens due to high refrigerant pressures, the compressor relay is de-energized immediately since the high pressure switch is in series with the compressor contactor coil. The high pressure fault recognition is immediate (does not delay for 30 continuous seconds before de-energizing the compressor). Note: For units with motorized water valve - One high pressure water switch is in series with refrigerant high pressure switch and will cause fault if pressure is 300 PSI (reset at 240 PSI).
Low pressure switch: The low pressure switch must be open and remain open for 30 continuous seconds during "on" cycle to be recognized as a low pressure fault. If the low pressure switch is open for 30 seconds prior to compressor power up it will be considered a low pressure (loss of charge) fault. The low pressure switch input is bypassed for the initial 120 seconds of a compressor run cycle.
Water coil low temperature (LT1): The LT1 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a LT1 fault. The LT1 input is bypassed for the initial 120 seconds of a compressor run cycle. LT1 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT1 fault has occurred.
Air coil low temperature (LT2): The LT2 thermistor temperature must be below the selected low temperature limit setting for 30 continuous seconds during a compressor run cycle to be recognized as a LT2 fault. The LT2 input is bypassed for the initial 60 seconds of a compressor run cycle. LT2 is set at the factory for one try. Therefore, the control will go into lockout mode once the LT2 fault has occurred.
Condensate overflow: The condensate overflow sensor must sense overflow level for 30 continuous seconds to be recognized as a CO fault. Condensate overflow will be monitored at all times.
Over/under voltage shutdown: An over/under voltage condition exists when the control voltage is outside the range of 19VAC to 30VAC. Over/under voltage shut down is a self-resetting safety. If the voltage comes back within range for at least 0.5 seconds, normal operation is restored. This is not considered a fault or lockout. If the CXM/DXM is in over/under voltage shutdown for 15 minutes, the alarm relay will close.
Unit Performance Sentinel-UPS (patent pending): The UPS feature indicates when the heat pump is operating inefficiently. A UPS condition exists when:

a. In heating mode with compressor energized, LT2 is greater than 125°F [52°C] for 30 continuous seconds, or:
b. In cooling mode with compressor energized, LT1 is greater than 125°F [52°C] for 30 continuous seconds, or:
c. In cooling mode with compressor energized, LT2 is less than 40°F [4.5°C] for 30 continuous seconds.

If a UPS condition occurs, the control will immediately go to UPS warning. The status LED will remain on as if the control is in normal mode. Outputs of the control, excluding LED and alarm relay, will NOT be affected by UPS. The UPS condition cannot occur during a compressor off cycle. During UPS warning, the alarm relay will cycle on and off. The cycle rate will be "on" for 5 seconds, "off" for 25 seconds, "on" for 5 seconds, "off" for 25 seconds, etc.

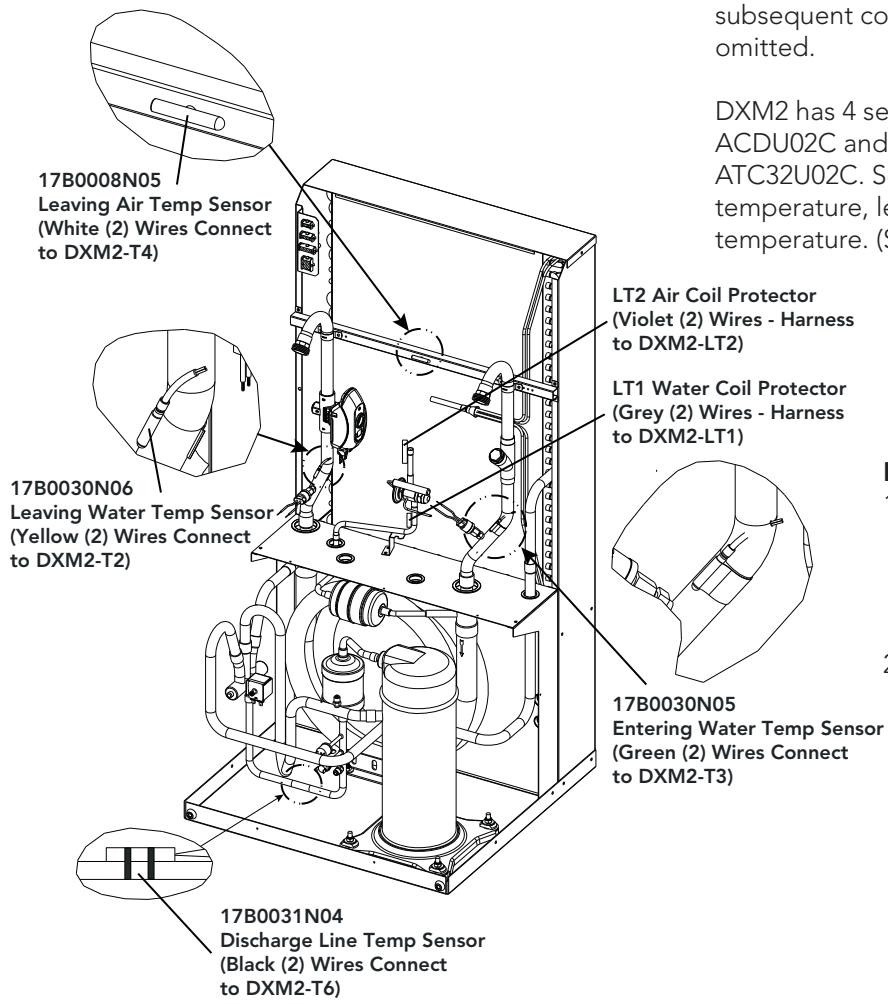
Swapped LT1/LT2 thermistors: During test mode, the control monitors to see if the LT1 and LT2 thermistors are in the appropriate places. If the control is in test mode, the control will lockout with code 9 after 30 seconds if:

a. The compressor is on in the cooling mode and the LT1 sensor is colder than the LT2 sensor, or:
b. The compressor is on in the heating mode and the LT2 sensor is colder than the LT1 sensor.

ESD (DXM2 only): The ESD (Emergency Shut Down) mode can be enabled from an external common signal to terminal ESD to shut down the unit. The green status light will flash code 3 when the unit is in ESD mode.

Diagnostic Features - The LED on the CXM board advises the technician of the current status of the CXM control. The LED can display either the current CXM mode or the last fault in memory if in test mode. If there is no fault in memory, the LED will flash Code 1 (when in test mode).

Figure 21: DXM2 Sensor Placement



⚠ CAUTION! ⚠

CAUTION! Do not restart units without inspection and remedy of faulting condition. Equipment damage may occur.

The green status LED and red fault LED on the DXM 2 board advise the technician of the current status of the DXM 2 control. The status LED will indicate the current mode that the DXM 2 control is in. The fault LED will ALWAYS flash a code representing the LAST fault in memory. If there is no fault in memory, the fault LED will flash Code 1. The yellow test LED will turn on when in test mode.

CXM/DXM 2 Control Start-up Operation - The control will not operate until all inputs and safety controls are checked for normal conditions. The compressor will have a 5 minute anti-short cycle delay at power-up. The first time after power-up that there is a call for compressor, the compressor will follow a 5 to 80 second random start delay. After the random start delay and anti-short cycle delay, the compressor relay will be energized. On all subsequent compressor calls, the random start delay is omitted.

DXM2 has 4 sensors that can be read with service tool ACDU02C and harness 17B0100N27 or thermostat ATC32U02C. Sensors are entering and leaving water temperature, leaving air temperature, and discharge line temperature. (See FIG 21)

Notes:

1. Sensors must be positioned on clean section of copper tube approximately as shown, clamped securely, and completely wrapped (except Leaving Air Sensor - Do Not wrap) with cork tape.
2. All sensors are NTC 10K OHM. To check calibration use resistance table in DXM2 AOM.

Unit Commissioning and Operating Conditions

Environment - This unit is designed for indoor installation only. Do not install in an area subject to freezing or where humidity levels can cause cabinet condensation.

Power Supply - A voltage variation of +/- 10% of nameplate utilization voltage is acceptable.

Operation and performance is primarily dependent upon return air temperature, airflow, water temperature, water flow rate and ambient air temperature. This water to air heat pump is capable of operating over a wide temperature range and with flow rates of between 1.5 GPM (.1 l/s) and 3 GPM (.19 l/s) per ton, however usually no more than one of these factors may be at a minimum or maximum level at a time.

The commissioning table 11 indicates air and water temperatures which are suitable for initial unit commissioning in an environment where the flow rate and water temperature is not yet stable and to avoid nuisance shut down of the units freeze and refrigerant pressure safeties.

The operating table 12 indicates the maximum and minimum ranges of the unit.

For more specific unit performance reference the product catalog, the submittal data sheets or contact your supplier for assistance.

Table 11: Building Commissioning Limits

BUILDING COMMISSIONING		
	ALL TSM MODELS	
	Cooling °F [°C]	Heating °F [°C]
AMBIENT MIN - MAX DB	45-110 [7-43]	40-85 [4.5-29]
RETURN AIR MIN DB/WB	60/45 [16/7]	40 [4.5]
RETURN AIR MAX DB/WB	100-83 [38-28]	80 [27]
STANDARD UNIT ENTERING WATER MIN* - MAX	40-120 [4.5-49]	60-90 [16-43]
EXTENDED RANGE STANDARD UNIT** ENTERING WATER MIN* - MAX	30-120 [-1-49]	20-90 [-6.7-32]
vFlow™ UNIT** ENTERING WATER MIN - MAX	20-120 [-1-49]	20-120 [-1-49]

*- Requires optional insulation package when operating below the dew point
**- Requires antifreeze, optional insulation package and jumper clipped.

Table 12: Unit Operating Limits

UNIT OPERATING LIMITS		
	ALL TSM MODELS	
	Cooling °F [°C]	Heating °F [°C]
AMBIENT MIN - MAX DB	50-100 [10-38]	50-85 [10-29]
RETURN AIR MIN DB/WB	65/60 [18/15.5]	50 [10]
RETURN AIR MAX DB/WB	95/75 [35/24]	80 [27]
STANDARD UNIT ENTERING WATER MIN* - MAX	50-120 [10-49]	60-90 [16-43]
EXTENDED RANGE STANDARD UNIT** ENTERING WATER MIN* - MAX	30-120 [-1-49]	20-90 [-6.7-32]
vFlow™ UNIT** ENTERING WATER MIN - MAX	20-120 [-1-49]	20-120 [-1-49]

*- Requires optional insulation package when operating below the dew point
**- Operation below 50°F (10) EWT requires antifreeze, optional insulation package and jumper clipped.

Unit and System Checkout

⚠ CAUTION! ⚠

CAUTION! To avoid possible damage to a plastic (PVC) piping system, do not allow temperatures to exceed 110ºF (43ºC).

Note: The manufacturer strongly recommends all piping connections, both internal and external to the unit, be pressure tested by an appropriate method prior to any finishing of the interior space or before access to all connections is limited. Test pressure may not exceed the maximum allowable pressure for the unit and all components within the water system. The manufacturer will not be responsible or liable for damages from water leaks due to inadequate or lack of a pressurized leak test, or damages caused by exceeding the maximum pressure rating during installation.

BEFORE POWERING SYSTEM, please check the following:

SYSTEM CHECKOUT

- ❑ System water temperature: Check water temperature for proper range and also verify heating and cooling set points for proper operation.
- ❑ System pH: Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings (see Table 3).
- ❑ System flushing: Verify that all hoses are connected end to end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- ❑ Cooling tower/boiler: Check equipment for proper set points and operation.
- ❑ Standby pumps: Verify that the standby pump is properly installed and in operating condition.
- ❑ System controls: Verify that system controls function and operate in the proper sequence.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- ❑ System control center: Verify that the control center and alarm panel have appropriate set points and are operating as designed.
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ CAUTION! ⚠

CAUTION! Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

⚠ CAUTION! ⚠

CAUTION! To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to the water loop. Heat exchangers never fully drain by themselves and will freeze unless winterized with antifreeze.

UNIT CHECKOUT

- ❑ Balancing/shutoff valves: Ensure that all isolation valves are open and water control valves are wired. Line voltage and wiring: Verify that voltage is within an acceptable range for the unit and wiring and fuses/breakers are properly sized. Verify that low voltage wiring is complete.
- ❑ Unit control transformer: Ensure that transformer has the properly selected voltage tap. Commercial 208-230V units are factory wired for 208V operation unless specified otherwise.
- ❑ Entering water and air: Ensure that entering water and air temperatures are within operating limits of Tables 11 & 12.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out on the CXM/DXM2 control is properly set.
- ❑ Unit fan: Manually rotate fan to verify free rotation and ensure that blower wheel is secured to the motor shaft. Be sure to remove any shipping supports if needed. DO NOT oil motors upon start-up. Fan motors are pre-oiled at the factory. Check unit fan speed selection and compare to design requirements.
- ❑ Condensate line: Verify that condensate line is open and properly pitched toward drain.
- ❑ Water flow balancing: Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flow that could erode heat exchangers.
- ❑ Unit air coil and filters: Ensure that filter is clean and accessible. Clean air coil of all manufacturing oils.
- ❑ Unit controls: Verify that CXM or DXM2 field selection options are properly set.

Unit Start-Up Procedures

Note: All Pre-Installation, Installation, Unit and System Checkout steps must be followed and completed before starting unit. Startup sequence and number of steps may change for your installation. Follow all safety precautions. Fill out startup log sheet(in this manual) as steps are completed. **Must be certified licensed service technician to perform startup and troubleshooting.**

If operation in any mode has excessive noise or vibration, stop and correct. Check and repair any water leakage.

1. Adjust all valves to their full open positions. Turn on the line power to all heat pumps.
2. Turn the thermostat fan position to FAN ON. Blower should start. Verify all speeds function.
3. Balance air flow at registers.
4. Room temperature should be within the minimum-maximum ranges of Tables 11 & 12. During start-up checks, loop water temperature entering the heat pump should be between 60°F [16°C] and 95°F [35°C]
5. Set thermostat to off position
6. Remove return air panel and open chassis control box.
   a. Turn on power, measure incoming high voltage at Compressor Contactor (CC), measure low voltage at board R and C.
   b. Amp clamp black wire from CC1 T1.
   c. Connect temperature thermocouples to entering and leaving water lines at the chassis. Note for units with DXM2- EWT, LWT, LAT, discharge line, LT1, and LT2 temperatures can be read with service tool or at communicating thermostat
7. Inner panel and filter must be on chassis to block air from bypassing air coil. Bypass air will cause unit to fault off.
8. Check cooling mode (Reversing valve energized)
   a. Set thermostat to cool and set temperature for 5 degrees lower than room temperature. It may take up to 5 minutes for compressor to start. Test mode will reduce safety time delay. Run 5 minutes minimum after compressor starts before taking data.
   b. Air leaving should be 10 to 25°F (5.5 and 14°C) lower than entering air. Check air coil, if humidity is over 50% coil face should be damp but not icing up.
   c. Water temperature leaving should be higher than entering, see Water temperature change table.
9. Check heating mode
   a. Set thermostat to heat and set temperature for 5 degrees higher than room temperature. It may take up to 5 minutes for compressor to start. Test mode will reduce safety time delay. Run 5 minutes minimum after compressor starts before taking data.
   b. Air leaving should be 20 to 30F (11 and 17 C) higher than entering air.
   c. Water temperature leaving should be lower than entering, see Water temperature change table.
10. When testing is completed
    a. set thermostat to owners instructions.
    b. Re assemble all parts.
11. Save start up log sheet for future reference.
12. BE CERTAIN TO FILL OUT AND FORWARD ALL WARRANTY REGISTRATION PAPERS TO CLIMATEMASTER.

Note: If performance during any mode appears abnormal, refer to the CXM and DXM2 sections or troubleshooting section of this manual. To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended.

⚠ WARNING! ⚠

WARNING! When the disconnect switch is closed, high voltage is present in some areas of the electrical panel. Exercise caution when working with energized equipment.

⚠ CAUTION! ⚠

CAUTION! Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

Table 13: Water Temperature Change Through Heat Exchanger

Water Flow, gpm (l/m)	Rise, Cooling °F (°C)	Drop, Heating °F (°C)
For Closed Loop: Ground Source or Closed Loop Systems at 3 gpm per ton (3.9 l/m per kw)	9 - 12 (5 - 6.7)	4 - 8 (2.2 - 4.4)
For Open Loop: Ground Water Systems at 1.5 gpm per ton (2.0 l/m per kw)	20 - 26 (11.1 - 14.4)	10 - 17 (5.6 - 9.4)

TSM Vertical Stack

Rev.:08/26/15

Unit Operating Pressures and Temperatures

Notes for Tables 14A - 14G:

- Airflow is at nominal (rated) conditions;
- Entering air is based upon 70°F [21°C] DB in heating and 80/67°F [27/19°C] in cooling;
- Subcooling is based upon head pressure at compressor service port;
- Cooling air and water values can vary greatly with changes in humidity level.

Table 14A: TSM09

Entering Water Temp °F	Water Flow GPM	Cooling									Heating								
		Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
20	1.5																		
	2.25																		
	3.0										60 - 63	289 - 306	148 - 163	14 - 18	71 - 75	9 - 12	8 - 17	3 - 4	20 - 22
30	1.5	122 - 125	197 - 204	90 - 105	42 - 46	49 - 53	13 - 16	15 - 20	20 - 24	22 - 23	67 - 71	297 - 315	147 - 162	20 - 24	72 - 76	10 - 12	9 - 18	8 - 9	22 - 23
	2.25	116 - 119	177 - 184	86 - 101	38 - 42	48 - 52	17 - 19	15 - 18	13 - 16	21 - 22	71 - 75	301 - 321	146 - 161	22 - 26	73 - 77	10 - 12	10 - 19	6 - 7	23 - 24
	3.0	112 - 115	168 - 173	97 - 112	36 - 40	39 - 43	19 - 21	14 - 18	10 - 12	21 - 22	74 - 76	303 - 323	146 - 161	23 - 27	73 - 77	11 - 13	10 - 19	4 - 5	23 - 25
50	1.5	128 - 134	240 - 252	107 - 122	62 - 66	51 - 55	11 - 14	13 - 16	20 - 22	21 - 22	97 - 102	333 - 355	139 - 154	37 - 41	77 - 81	9 - 11	13 - 21	11 - 12	29 - 30
	2.25	122 - 131	219 - 233	102 - 117	59 - 63	51 - 55	12 - 17	12 - 16	13 - 15	21 - 22	104 - 108	339 - 361	139 - 154	40 - 44	79 - 83	9 - 11	13 - 21	8 - 9	30 - 31
	3.0	119 - 129	209 - 224	104 - 119	58 - 62	47 - 51	13 - 18	11 - 15	10 - 11	21 - 22	107 - 122	342 - 369	139 - 154	41 - 45	79 - 83	9 - 11	13 - 20	6 - 7	31 - 32
70	1.5	132 - 139	311 - 329	127 - 142	82 - 86	53 - 57	9 - 12	12 - 15	19 - 21	20 - 21	130 - 135	367 - 392	138 - 153	52 - 56	84 - 88	9 - 11	13 - 21	14 - 16	35 - 37
	2.25	131 - 137	287 - 306	121 - 136	80 - 84	53 - 57	10 - 13	10 - 12	13 - 14	20 - 21	139 - 144	375 - 402	138 - 153	55 - 59	85 - 89	10 - 11	13 - 20	10 - 12	37 - 38
	3.0	131 - 136	275 - 294	118 - 133	79 - 83	53 - 57	10 - 13	9 - 11	9 - 11	20 - 21	145 - 149	380 - 407	138 - 153	57 - 61	86 - 90	10 - 11	13 - 19	8 - 9	38 - 39
90	1.5	137 - 144	400 - 420	149 - 164	101 - 105	55 - 59	8 - 10	13 - 16	19 - 20	19 - 20	164 - 169	401 - 430	139 - 154	64 - 68	90 - 94	10 - 13	13 - 17	18 - 20	41 - 43
	2.25	135 - 142	373 - 395	142 - 157	99 - 103	55 - 59	9 - 11	10 - 12	12 - 14	19 - 20	175 - 178	411 - 442	141 - 156	68 - 72	92 - 96	12 - 16	14 - 17	12 - 14	43 - 45
	3.0	135 - 141	359 - 383	138 - 153	98 - 102	56 - 60	9 - 12	9 - 11	9 - 10	19 - 20	179 - 187	415 - 455	142 - 157	69 - 73	93 - 97	13 - 18	14 - 16	9 - 11	44 - 46
100	1.5	139 - 147	448 - 471	161 - 176	110 - 114	56 - 60	8 - 9	13 - 16	18 - 20	18 - 19									
	2.25	138 - 146	420 - 445	155 - 170	108 - 112	56 - 60	8 - 10	11 - 13	12 - 13	18 - 19									
	3.0	138 - 146	405 - 432	151 - 166	108 - 112	57 - 61	8 - 10	10 - 11	9 - 10	18 - 19									
120	1.5	144 - 153	549 - 583	186 - 201	128 - 132	58 - 62	7 - 8	15 - 17	17 - 19	17 - 18									
	2.25	143 - 153	525 - 557	181 - 196	126 - 130	58 - 62	7 - 8	12 - 14	11 - 13	17 - 18									
	3.0	143 - 152	511 - 543	180 - 195	126 - 130	57 - 61	8 - 9	11 - 13	9 - 10	17 - 18									

Table 14B: TSM12

Entering Water Temp °F	Water Flow GPM	Cooling									Heating								
		Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
20	1.5																		
	2.25																		
	3.0										60 - 63	289 - 306	151 - 166	13 - 17	72 - 76	9 - 12	8 - 17	3 - 4	20 - 22
30	1.5	122 - 125	197 - 204	82 - 97	40 - 44	45 - 49	13 - 16	15 - 20	20 - 24	22 - 23	67 - 71	297 - 315	153 - 168	18 - 22	73 - 77	10 - 12	9 - 18	8 - 9	22 - 23
	2.25	116 - 119	177 - 184	77 - 92	37 - 41	44 - 48	17 - 19	15 - 18	13 - 16	21 - 22	71 - 75	301 - 321	151 - 166	21 - 25	74 - 78	10 - 12	10 - 19	6 - 7	23 - 24
	3.0	112 - 115	168 - 173	89 - 104	36 - 40	38 - 42	19 - 21	14 - 18	10 - 12	21 - 22	74 - 76	303 - 323	151 - 166	22 - 26	74 - 78	11 - 13	10 - 19	4 - 5	23 - 25
50	1.5	128 - 134	240 - 252	103 - 118	59 - 63	48 - 52	11 - 14	13 - 16	20 - 22	21 - 22	97 - 102	333 - 355	145 - 160	35 - 39	78 - 82	9 - 11	13 - 21	11 - 12	29 - 30
	2.25	122 - 131	219 - 233	97 - 112	57 - 61	47 - 51	12 - 17	12 - 16	13 - 15	21 - 22	104 - 108	339 - 361	144 - 159	39 - 43	79 - 83	9 - 11	13 - 21	8 - 9	30 - 31
	3.0	119 - 129	209 - 224	100 - 115	56 - 60	45 - 49	13 - 18	11 - 15	10 - 11	21 - 22	107 - 122	342 - 369	143 - 158	40 - 44	80 - 84	9 - 11	13 - 20	6 - 7	31 - 32
70	1.5	132 - 139	311 - 329	125 - 139	78 - 82	51 - 55	9 - 12	12 - 15	19 - 21	20 - 21	130 - 135	367 - 392	141 - 156	52 - 56	86 - 90	9 - 11	13 - 21	14 - 16	35 - 37
	2.25	131 - 137	287 - 306	119 - 134	76 - 80	50 - 54	10 - 13	10 - 12	13 - 14	20 - 21	139 - 144	375 - 402	141 - 156	56 - 60	88 - 92	10 - 11	13 - 20	10 - 12	37 - 38
	3.0	131 - 136	275 - 294	115 - 130	75 - 79	50 - 54	10 - 13	9 - 11	9 -11	20 - 21	145 - 149	380 - 407	141 - 156	58 - 62	90 - 94	10 - 11	13 - 19	8 - 9	38 - 39
90	1.5	137 - 144	400 - 420	147 - 162	98 - 102	53 - 57	8 - 10	13 - 16	19 - 20	19 - 20	164 - 169	401 - 430	143 - 158	65 - 69	94 - 98	10 - 13	13 - 17	18 - 20	41 - 43
	2.25	135 - 142	373 - 395	141 - 156	96 - 100	53 - 57	9 - 11	10 - 12	12 - 14	19 - 20	175 - 178	411 - 442	143 - 158	70 - 74	99 - 103	12 - 16	14 - 17	12 - 14	43 - 45
	3.0	135 - 141	359 - 383	136 - 151	95 - 99	54 - 58	9 - 12	9 - 11	9 - 10	19 - 20	179 - 187	415 - 455	143 - 158	73 - 77	101 - 105	13 - 18	14 - 16	9 - 11	44 - 46
100	1.5	139 - 147	448 - 471	158 - 173	107 - 111	55 - 59	8 - 9	13 - 16	18 - 20	18 - 19									
	2.25	138 - 146	420 - 445	152 - 167	105 - 109	54 - 58	8 - 10	11 - 13	12 - 13	18 - 19									
	3.0	138 - 146	405 - 432	148 - 163	105 - 109	55 - 59	8 - 10	10 - 11	9 - 10	18 - 19									
120	1.5	144 - 153	549 - 583	181 - 196	126 - 130	57 - 61	7 - 8	15 - 17	17 - 19	17 - 18									
	2.25	143 - 153	525 - 557	175 - 190	125 - 129	57 - 61	7 - 8	12 - 14	11 - 13	17 - 18									
	3.0	143 - 152	511 - 543	176 - 191	124 - 128	56 - 60	8 - 9	11 - 13	9 - 10	17 - 18									

Unit Operating Pressures and Temperatures

Table 14C: TSM15

Entering Water Temp °F	Water Flow GPM	Cooling									Heating								
		Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
20	1.5																		
	2.25																		
	3.0										60 - 63	289 - 306	154 - 169	14 - 18	74 - 78	9 - 12	8 - 17	3 - 4	20 - 22
30	1.5	122 - 125	197 - 204	105 - 120	38 - 42	46 - 50	13 - 16	15 - 20	20 - 24	22 - 23	67 - 71	297 - 315	150 - 165	20 - 24	76 - 80	10 - 12	9 - 18	8 - 9	22 - 23
	2.25	116 - 119	177 - 184	116 - 131	34 - 38	41 - 45	17 - 19	15 - 18	13 - 16	21 - 22	71 - 75	301 - 321	149 - 164	22 - 26	76 - 80	10 - 12	10 - 19	6 - 7	23 - 24
	3.0	112 - 115	168 - 173	113 - 128	36 - 40	36 - 40	19 - 21	14 - 18	10 - 12	21 - 22	74 - 76	303 - 323	149 - 164	23 - 27	76 - 80	11 - 13	10 - 19	4 - 5	23 - 25
50	1.5	128 - 134	240 - 252	114 - 129	61 - 65	49 - 53	11 - 14	13 - 16	20 - 22	21 - 22	97 - 102	333 - 355	148 - 163	36 - 40	80 - 84	9 - 11	13 - 21	11 - 12	29 - 30
	2.25	122 - 131	219 - 233	117 - 132	57 - 61	47 - 51	12 - 17	12 - 16	13 - 15	21 - 22	104 - 108	339 - 361	148 - 163	38 - 42	80 - 84	9 - 11	13 - 21	8 - 9	30 - 31
	3.0	119 - 129	209 - 224	117 - 132	57 - 61	44 - 48	13 - 18	11 - 15	10 - 11	21 - 22	107 - 122	342 - 369	149 - 164	39 - 43	80 - 84	9 - 11	13 - 20	6 - 7	31 - 32
70	1.5	132 - 139	311 - 329	128 - 143	82 - 86	53 - 57	9 - 12	12 - 15	19 - 21	20 - 21	130 - 135	367 - 392	148 - 163	48 - 52	85 - 89	9 - 11	13 - 21	14 - 16	35 - 37
	2.25	131 - 137	287 - 306	126 - 141	79 - 83	51 - 55	10 - 13	10 - 12	13 - 14	20 - 21	139 - 144	375 - 402	149 - 164	51 - 55	86 - 90	10 - 11	13 - 20	10 - 12	37 - 38
	3.0	131 - 136	275 - 294	126 - 141	78 - 82	51 - 55	10 - 13	9 - 11	9 -11	20 - 21	145 - 149	380 - 407	150 - 165	52 - 56	86 - 90	10 - 11	13 - 19	8 - 9	38 - 39
90	1.5	137 - 144	400 - 420	147 - 162	101 - 105	56 - 60	8 - 10	13 - 16	19 - 20	19 - 20	164 - 169	401 - 430	152 - 167	59 - 63	91 - 95	10 - 13	13 - 17	18 - 20	41 - 43
	2.25	135 - 142	373 - 395	142 - 157	99 - 103	55 - 59	9 - 11	10 - 12	12 - 14	19 - 20	175 - 178	411 - 442	154 - 169	62 - 66	92 - 96	12 - 16	14 - 17	12 - 14	43 - 45
	3.0	135 - 141	359 - 383	142 - 157	98 - 102	55 - 59	9 - 12	9 - 11	9 - 10	19 - 20	179 - 187	415 - 455	155 - 170	64 - 68	92 - 96	13 - 18	14 - 16	9 - 11	44 - 46
100	1.5	139 - 147	448 - 471	158 - 173	110 - 114	57 - 61	8 - 9	13 - 16	18 - 20	18 - 19									
	2.25	138 - 146	420 - 445	153 - 168	109 - 103	57 - 61	8 - 10	11 - 13	12 - 13	18 - 19									
	3.0	138 - 146	405 - 432	152 - 167	107 - 101	56 - 60	8 - 10	10 - 11	9 - 10	18 - 19									
120	1.5	144 - 153	549 - 583	185 - 200	128 - 132	59 - 63	7 - 8	15 - 17	17 - 19	17 - 18									
	2.25	143 - 153	525 - 557	180 - 195	127 - 131	59 - 63	7 - 8	12 - 14	11 - 13	17 - 18									
	3.0	143 - 152	511 - 543	177 - 192	127 - 131	57 - 61	8 - 9	11 - 13	9 - 10	17 - 18									

Table 14D: TSM18

Entering Water Temp °F	Water Flow GPM	Cooling									Heating								
		Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
20	1.5																		
	2.25																		
	3.0										60 - 63	289 - 306	154 - 169	14 - 18	74 - 78	9 - 12	8 - 17	3 - 4	20 - 22
30	1.5	122 - 125	197 - 204	105 - 120	38 - 42	46 - 50	13 - 16	15 - 20	20 - 24	22 - 23	67 - 71	297 - 315	150 - 165	20 - 24	76 - 80	10 - 12	9 - 18	8 - 9	22 - 23
	2.25	116 - 119	177 - 184	116 - 131	34 - 38	41 - 45	17 - 19	15 - 18	13 - 16	21 - 22	71 - 75	301 - 321	149 - 164	22 - 26	76 - 80	10 - 12	10 - 19	6 - 7	23 - 24
	3.0	112 - 115	168 - 173	113 - 128	36 - 40	36 - 40	19 - 21	14 - 18	10 - 12	21 - 22	74 - 76	303 - 323	149 - 164	23 - 27	76 - 80	11 - 13	10 - 19	4 - 5	23 - 25
50	1.5	128 - 134	240 - 252	114 - 129	61 - 65	49 - 53	11 - 14	13 - 16	20 - 22	21 - 22	97 - 102	333 - 355	148 - 163	36 - 40	80 - 84	9 - 11	13 - 21	11 - 12	29 - 30
	2.25	122 - 131	219 - 233	117 - 132	57 - 61	47 - 51	12 - 17	12 - 16	13 - 15	21 - 22	104 - 108	339 - 361	148 - 163	38 - 42	80 - 84	9 - 11	13 - 21	8 - 9	30 - 31
	3.0	119 - 129	209 - 224	117 - 132	57 - 61	44 - 48	13 - 18	11 - 15	10 - 11	21 - 22	107 - 122	342 - 369	149 - 164	39 - 43	80 - 84	9 - 11	13 - 20	6 - 7	31 - 32
70	1.5	132 - 139	311 - 329	128 - 143	82 - 86	53 - 57	9 - 12	12 - 15	19 - 21	20 - 21	130 - 135	367 - 392	148 - 163	48 - 52	85 - 89	9 - 11	13 - 21	14 - 16	35 - 37
	2.25	131 - 137	287 - 306	126 - 141	79 - 83	51 - 55	10 - 13	10 - 12	13 - 14	20 - 21	139 - 144	375 - 402	149 - 164	51 - 55	86 - 90	10 - 11	13 - 20	10 - 12	37 - 38
	3.0	131 - 136	275 - 294	126 - 141	78 - 82	51 - 55	10 - 13	9 - 11	9 -11	20 - 21	145 - 149	380 - 407	150 - 165	52 - 56	86 - 90	10 - 11	13 - 19	8 - 9	38 - 39
90	1.5	137 - 144	400 - 420	147 - 162	101 - 105	56 - 60	8 - 10	13 - 16	19 - 20	19 - 20	164 - 169	401 - 430	152 - 167	59 - 63	91 - 95	10 - 13	13 - 17	18 - 20	41 - 43
	2.25	135 - 142	373 - 395	142 - 157	99 - 103	55 - 59	9 - 11	10 - 12	12 - 14	19 - 20	175 - 178	411 - 442	154 - 169	62 - 66	92 - 96	12 - 16	14 - 17	12 - 14	43 - 45
	3.0	135 - 141	359 - 383	142 - 157	98 - 102	55 - 59	9 - 12	9 - 11	9 - 10	19 - 20	179 - 187	415 - 455	155 - 170	64 - 68	92 - 96	13 - 18	14 - 16	9 - 11	44 - 46
100	1.5	139 - 147	448 - 471	158 - 173	110 - 114	57 - 61	8 - 9	13 - 16	18 - 20	18 - 19									
	2.25	138 - 146	420 - 445	153 - 168	109 - 103	57 - 61	8 - 10	11 - 13	12 - 13	18 - 19									
	3.0	138 - 146	405 - 432	152 - 167	107 - 101	56 - 60	8 - 10	10 - 11	9 - 10	18 - 19									
120	1.5	144 - 153	549 - 583	185 - 200	128 - 132	59 - 63	7 - 8	15 - 17	17 - 19	17 - 18									
	2.25	143 - 153	525 - 557	180 - 195	127 - 131	59 - 63	7 - 8	12 - 14	11 - 13	17 - 18									
	3.0	143 - 152	511 - 543	177 - 192	127 - 131	57 - 61	8 - 9	11 - 13	9 - 10	17 - 18									

Table 14E: TSM24

Entering Water Temp °F	Water Flow GPM	Cooling									Heating								
		Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
20	1.5																		
	2.25																		
	3.0										60 - 63	289 - 306	145 - 160	15 - 19	74 - 78	9 - 12	8 - 17	3 - 4	20 - 22
30	1.5	122 - 125	197 - 204	78 - 93	35 - 39	46 - 50	13 - 16	15 - 20	20 - 24	22 - 23	67 - 71	297 - 315	145 - 160	21 - 25	75 - 79	10 - 12	9 - 18	8 - 9	22 - 23
	2.25	116 - 119	177 - 184	76 - 91	38 - 42	45 - 49	17 - 19	15 - 18	13 - 16	21 - 22	71 - 75	301 - 321	144 - 159	22 - 26	75 - 79	10 - 12	10 - 19	6 - 7	23 - 24
	3.0	112 - 115	168 - 173	94 - 109	37 - 41	39 - 43	19 - 21	14 - 18	10 - 12	21 - 22	74 - 76	303 - 323	144 - 159	23 - 27	76 - 80	11 - 13	10 - 19	4 - 5	23 - 25
50	1.5	128 - 134	240 - 252	98 - 113	57 - 61	50 - 54	11 - 14	13 - 16	20 - 22	21 - 22	97 - 102	333 - 355	142 - 157	38 - 42	81 - 85	9 - 11	13 - 21	11 - 12	29 - 30
	2.25	122 - 131	219 - 233	94 - 109	56 - 60	49 - 53	12 - 17	12 - 16	13 - 15	21 - 22	104 - 108	339 - 361	142 - 157	40 - 44	82 - 86	9 - 11	13 - 21	8 - 9	30 - 31
	3.0	119 - 129	209 - 224	99 - 114	56 - 60	47 - 51	13 - 18	11 - 15	10 - 11	21 - 22	107 - 122	342 - 369	142 - 157	42 - 46	82 - 86	9 - 11	13 - 20	6 - 7	31 - 32
70	1.5	132 - 139	311 - 329	120 - 135	77 - 81	53 - 57	9 - 12	12 - 15	19 - 21	20 - 21	130 - 135	367 - 392	144 - 159	53 - 57	88 - 92	9 - 11	13 - 21	14 - 16	35 - 37
	2.25	131 - 137	287 - 306	115 - 130	76 - 80	53 - 57	10 - 13	10 - 12	13 - 14	20 - 21	139 - 144	375 - 402	145 - 160	56 - 60	90 - 94	10 - 11	13 - 20	10 - 12	37 - 38
	3.0	131 - 136	275 - 294	113 - 128	76 - 80	53 - 57	10 - 13	9 - 11	9 -11	20 - 21	145 - 149	380 - 407	146 - 161	57 - 61	90 - 94	10 - 11	13 - 19	8 - 9	38 - 39
90	1.5	137 - 144	400 - 420	145 - 160	97 - 101	56 - 60	8 - 10	13 - 16	19 - 20	19 - 20	164 - 169	401 - 430	145 - 160	68 - 72	98 - 102	10 - 13	13 - 17	18 - 20	41 - 43
	2.25	135 - 142	373 - 395	140 - 155	95 - 99	53 - 57	9 - 11	10 - 12	12 - 14	19 - 20	175 - 178	411 - 442	147 - 162	71 - 75	100 - 104	12 - 16	14 - 17	12 - 14	43 - 45
	3.0	135 - 141	359 - 383	135 - 150	94 - 98	57 - 61	9 - 12	9 - 11	9 - 10	19 - 20	179 - 187	415 - 455	148 - 163	73 - 77	101 - 105	13 - 18	14 - 16	9 - 11	44 - 46
100	1.5	139 - 147	448 - 471	159 - 174	106 - 110	57 - 61	8 - 9	13 - 16	18 - 20	18 - 19									
	2.25	138 - 146	420 - 445	153 - 168	104 - 108	56 - 60	8 - 10	11 - 13	12 - 13	18 - 19									
	3.0	138 - 146	405 - 432	149 - 164	104 - 108	57 - 61	8 - 10	10 - 11	9 - 10	18 - 19									
120	1.5	144 - 153	549 - 583	188 - 203	123 - 127	58 - 62	7 - 8	15 - 17	17 - 19	17 - 18									
	2.25	143 - 153	525 - 557	183 - 198	122 - 126	58 - 62	7 - 8	12 - 14	11 - 13	17 - 18									
	3.0	143 - 152	511 - 543	183 - 198	122 - 126	57 - 61	8 - 9	11 - 13	9 - 10	17 - 18									

Unit Operating Pressures and Temperatures

Table 14F: TSM30

Entering Water Temp °F	Water Flow GPM	Cooling									Heating								
		Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
20	1.5																		
	2.25																		
	3.0										63 - 67	289 - 306	160 - 175	14 - 18	89 - 93	9 - 12	4 - 6	3 - 4	18 - 20
30	1.5	116 - 118	160 - 165	102 -117	42 - 46	46 - 50	13 - 16	14 - 16	18 - 20	22 - 23	72 - 75	297 - 315	157 - 172	19 - 23	90 - 94	10 - 12	4 - 6	7 - 9	19 - 20
	2.25	113 - 116	150 - 155	115 - 130	37 - 41	43 - 47	17 - 19	14 - 16	11 - 13	21 - 22	75 - 78	301 - 321	156 - 171	21 - 25	91 - 95	10 - 12	4 - 6	6 - 7	20 - 22
	3.0	104 - 107	145 - 150	117 - 132	36 - 40	39 - 43	19 - 21	14 - 16	9 - 11	19 - 21	78 - 82	303 - 323	155 - 170	23 - 27	91 - 95	11 - 13	4 - 6	4 - 5	20 - 22
50	1.5	128 - 132	215 - 225	111 - 126	63 - 67	50 - 54	15 - 18	13 - 16	20 - 22	21 - 22	104 - 110	333 - 355	150 - 165	35 - 39	96 - 100	9 - 11	6 - 7	10 - 11	26 - 28
	2.25	122 - 127	200 - 210	115 - 130	59 - 63	48 - 52	19 - 21	11 - 14	11 - 13	21 - 22	108 - 114	336 - 358	150 - 165	38 - 42	97 - 101	11 - 13	6 - 7	8 - 9	26 - 28
	3.0	119 - 125	195 - 205	116 - 131	57 - 61	46 - 50	18 - 20	12 - 15	9 - 11	21 - 22	107 - 113	333 - 355	150 - 165	39 - 43	97 - 101	9 - 11	6 - 7	6 - 7	26 - 28
70	1.5	132 - 139	293 - 303	127 - 142	82 - 86	54 - 58	9 - 12	10 - 12	18 - 20	20 - 21	132 - 137	359 - 369	150 - 165	49 - 53	103 - 107	12 - 14	6 - 7	14 - 16	32 - 34
	2.25	131 - 136	273 - 283	124 - 139	80 - 84	53 - 57	10 - 13	9 - 11	12 - 14	20 - 21	139 - 144	366 - 376	151 - 166	52 - 56	104 - 108	14 - 16	6 - 7	10 - 12	32 - 34
	3.0	132 - 137	263 - 273	124 - 139	78 - 82	52 - 56	13 - 15	9 - 11	9 - 11	20 - 21	144 - 148	374 - 384	153 - 168	53 - 57	105 - 109	14 - 16	6 - 7	8 - 9	32 - 34
90	1.5	137 - 144	358 - 368	149 - 164	101 - 105	57 - 61	10 - 11	10 - 12	16 - 18	19 - 20	164 - 169	395 - 405	160 - 175	57 - 61	106 - 110	20-24	7 - 8	16	35 - 37
	2.25	136 - 142	335 - 345	142 - 157	99 - 103	56 - 60	9 - 11	10 - 12	12 - 14	19 - 20	173 - 178	403 - 413	164 - 179	59 - 63	107 - 111	22-26	8 - 9	10 - 12	36 - 38
	3.0	134 - 140	328 - 338	141 - 156	97 -101	56 - 60	10 - 12	9 - 11	9 - 10	19 - 20	179 - 187	415 - 425	166 - 181	60 - 64	107 - 111	24-28	9 - 10	9 - 11	36 - 38
100	1.5	143 - 148	430 - 440	163 - 178	110 - 114	58 - 62	8 - 9	10 - 12	18 - 20	18 - 19									
	2.25	142 - 147	407 - 417	155 - 170	109 - 113	58 - 62	8 - 10	8 - 10	13 - 15	18 - 19									
	3.0	141 - 146	395 - 405	153 - 168	107 - 111	58 - 62	9 - 11	7 - 9	9 - 10	18 - 19									
120	1.5	148 - 152	533 - 543	195 - 210	127 - 131	61 - 65	9 - 11	9 - 11	15 - 17	17 - 18									
	2.25	150 - 155	513 - 523	187 - 202	126 - 130	61 - 65	8 - 10	7 - 9	10 - 12	17 - 18									
	3.0	147 - 152	502 - 512	183 - 198	125 - 129	60 - 64	9 - 11	7 - 9	8 - 10	17 - 18									

Table 14G: TSM36

Entering Water Temp °F	Water Flow GPM	Cooling									Heating								
		Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Rise °F	Air Temp Drop °F DB	Suction Pressure PSIG	Discharge Pressure PSIG	Discharge Temp °F	LT1 Temp °F	LT2 Temp °F	Super-heat	Sub-cooling	Water Temp Drop °F	Air Temp Rise °F DB
20	1.5																		
	2.25																		
	3.0										63 - 65	289 - 306	157 - 172	15 - 19	89 - 93	8 - 11	2 - 4	3 - 4	15 - 17
30	1.5	121 - 125	197 - 207	100 - 115	41 - 45	44 - 48	14 - 17	15 - 18	17 - 19	20 - 22	69 - 73	295 - 305	153 - 168	20 - 24	90 - 94	8 - 11	2 - 4	8 - 10	20 - 22
	2.25	119 - 123	174 - 184	96 - 111	38 - 42	44 - 48	16 - 19	15 - 18	12 - 14	21 - 23	73 - 76	295 - 305	152 - 167	23 - 27	91 - 95	8 - 11	3 - 5	4 - 6	19 - 22
	3.0	118 - 122	157 - 163	97 - 112	37 - 41	40 - 44	16 - 19	14 - 17	10 - 12	22 - 25	78 - 82	295 - 305	151 - 166	24 - 28	92 - 96	8 - 11	3 - 5	4 - 6	19 - 22
50	1.5	128 - 132	243 - 253	114 - 129	59 - 63	48 - 52	9 - 12	19 - 22	20 - 22	19 - 21	97 - 102	325 - 335	149 - 164	37 - 41	95 - 99	9 - 12	4 - 6	11 - 13	26 - 28
	2.25	126 - 130	226 - 236	108 - 123	57 - 61	47 - 51	9 - 12	16 - 19	15 - 19	22 - 24	104 - 108	329 - 339	149 - 164	39 - 43	96 - 100	8 - 11	4 - 6	10 - 12	17 - 19
	3.0	130 - 134	213 - 223	107 - 122	56 - 60	46 - 50	12 - 15	12 - 15	9 - 11	22 - 24	108 - 112	334 - 344	149 - 164	41 - 45	97 - 101	9 - 12	4 - 6	6 - 8	28 - 30
70	1.5	132 - 136	228 - 238	135 - 150	78 - 82	51 - 55	9 - 12	18 - 21	21 - 23	19 - 21	131 - 136	359 - 369	149 - 164	51 - 55	102 - 106	9 - 12	3 - 5	14 - 16	31 - 33
	2.25	133 - 137	297 - 307	128 - 143	76 - 80	51 - 55	9 - 12	17 - 19	16 - 19	20 - 22	138 - 142	366 - 376	150 - 165	55 - 59	104 - 108	10 - 13	3 - 5	6 - 8	34 - 36
	3.0	132 - 134	287 - 297	125 - 140	75 - 79	51 - 55	10 - 13	14 - 17	9 - 11	21 - 23	144 - 148	374 - 384	151 - 166	57 - 61	105 - 109	10 - 13	3 - 5	8 - 10	35 - 37
90	1.5	137 - 144	400 - 420	163 - 178	96 - 100	55 - 59	8 - 10	13 - 16	19 - 20	19 - 20	164 - 169	395 - 405	153 - 168	64 - 68	110 - 114	10 - 13	3 - 5	18 - 20	39 - 41
	2.25	135 - 142	373 - 395	155 - 170	94 - 98	54 - 58	9 - 11	10 - 12	12 - 14	19 - 20	173 - 178	403 - 413	155 - 170	68 - 72	113 - 117	12 - 15	3 - 5	14 - 16	41 - 43
	3.0	135 - 141	359 - 383	151 - 166	93 - 97	54 - 58	9 - 12	9 - 11	9 - 10	19 - 20	179 - 187	415 - 425	156 - 171	71 - 75	114 - 118	13 - 18	3 - 5	9 - 11	42 - 44
100	1.5	139 - 147	450 - 460	180 - 195	105 - 109	56 - 60	8 - 9	20 - 23	14 - 16	19 - 20									
	2.25	138 - 146	420 - 445	171 - 186	104 - 108	56 - 60	8 - 10	11 - 13	12 - 13	18 - 19									
	3.0	138 - 146	405 - 432	166 - 181	103 - 107	56 - 60	8 - 10	10 - 11	9 - 10	18 - 19									
120	1.5	144 - 153	560 - 590	218 - 233	123 - 127	59 - 63	6 - 8	15 - 17	17 - 19	17 - 18									
	2.25	143 - 153	540 - 560	208 - 223	122 - 126	58 - 62	6 - 8	12 - 14	11 - 13	17 - 18									
	3.0	143 - 152	535 - 565	203 - 218	121 - 125	58 - 62	6 - 8	17 - 20	10 - 12	18 - 19									

Coax Water Pressure Drop

Model	GPM	Pressure Drop, PSI				PD Added for
		30°F	50°F	70°F	90°F	Add for MWV
TSM09	1.5	1.1	0.5	0.4	0.3	0.3
	2.3	1.8	1.6	1.4	1.5	0.5
	3.0	4.7	3.6	3.0	3.1	0.6
TSM12	1.8	3.4	2.3	2.2	2.1	0.4
	2.6	5.6	4.2	4.0	3.7	0.5
	3.5	7.8	7.7	6.2	5.5	0.7
TSM15	2.3	2.3	2.1	2.0	1.9	0.2
	3.5	5.0	4.2	4.2	3.9	0.3
	4.5	8.3	7.1	6.9	6.6	0.4
TSM18	3.4	2.2	1.5	1.4	1.1	0.3
	5.1	4.2	3.3	2.4	2.8	0.5
	6.8	6.7	4.4	4.2	4.0	0.7
TSM24	4.0	0.9	0.5	0.4	0.3	0.4
	6.0	2.3	2.2	1.8	1.8	0.6
	8.0	5.0	4.3	3.8	3.2	0.8
TSM30	4.0	0.9	0.5	0.4	0.3	0.4
	6.0	2.3	2.2	1.8	1.8	0.6
	8.0	5.0	4.3	3.8	3.2	0.8
TSM36	4.5	2.8	0.9	0.8	0.8	0.4
	6.0	3.8	2.4	2.2	2.1	0.7
	9.0	7.4	4.7	4.3	4.0	0.9

Start-Up Log Sheet

Installer: Complete unit and system checkout and follow unit start-up procedures in the IOM. Use this form to record unit information, temperatures and pressures during start-up. Keep this form for future reference.

Job Name: _____ **Street Address:** _____
Chassis Model Number: _____ **Serial Number:** _____
Cabinet Model Number: _____ **Serial Number:** _____
Unit Location in Building: _____
Date: _____ **Sales Order No:** _____

In order to minimize troubleshooting and costly system failures, complete the following checks and data entries before the system is put into full operation.

PCS Motor: (Circle) HI TAP, MED TAP, LOW TAP

Temperatures: (Circle) F or C

Pressures: (Circle) PSIG or kPa

ECM Motor CFM Setting:
Cooling - (Circle) Default, Min, Max, or _____
Heating - (Circle) Default, Min, Max, or _____

Antifreeze: _____ **Type:** _____ **%**

	Cooling Mode	Heating Mode
Temperatures		
Return-Air DB		
Supply-Air DB		
Air Temperature Differential		
Entering Fluid		
Leaving Fluid		
Fluid Temperature Differential		
Units with DXM2 *		
LT1		
LT2		
Discharge Line		
Leaving Air		
Voltages		
Supply at Unit		
Transformer Low Side		
Amps		
Compressor		

Allow unit to run 15 minutes in each mode before taking data.
Do not connect refrigerant gauges during start up unless instructed by ClimateMaster service tech.
*Temperatures can be read with service tool or communicating thermostat.

Preventive Maintenance

Water Coil Maintenance
(Direct ground water applications only)
If the system is installed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the well water applications section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.5 gpm per ton [2.0 l/m per kW] is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50°F [10°C] is 2.0 gpm per ton [2.6 l/m per kW].

Water Coil Maintenance
(All other water loop applications)
Generally water coil maintenance is not needed for closed loop systems. However, if the piping is known to have high dirt or debris content, it is best to establish a periodic maintenance schedule with the owner so the water coil can be checked regularly. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system. Open cooling towers requiring heavy chemical treatment and mineral buildup through water use can also contribute to higher maintenance. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with both the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. However, flow rates over 3 gpm per ton (3.9 l/m per kW) can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

Filters - Filters must be clean to obtain maximum performance. Filters should be inspected every month under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Washable, high efficiency, electrostatic filters, when dirty, can exhibit a very high pressure drop for the fan motor and reduce air flow, resulting in poor performance. It is especially important to provide consistent washing of these filters (in the opposite direction of the normal air flow) once per month using a high pressure wash similar to those found at self-serve car washes.

Condensate Drain - In areas where airborne bacteria may produce a "slimy" substance in the drain pan, it may be necessary to treat the drain pan chemically with an algaecide approximately every three months to minimize the problem. The condensate pan may also need to be cleaned periodically to ensure indoor air quality. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect the drain twice a year to avoid the possibility of plugging and eventual overflow.

Compressor - Conduct annual amperage checks to ensure that amp draw is no more than 10% greater than indicated on the serial plate data.

Fan Motors - All units have lubricated fan motors. Fan motors should never be lubricated unless obvious, dry operation is suspected. Periodic maintenance oiling is not recommended, as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data.

Air Coil - The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Care must be taken not to damage the aluminum fins while cleaning. CAUTION: Fin edges are sharp.

Cabinet - Check inside cabinet once a year. Gently brush or vacuum clean if needed. Do not tear insulation, repair with foil tape.

Refrigerant System - To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

All product families have transitioned to CoreMax® high flow service valves. In place of Schrader ports.

The CoreMax® system:
- Permits up to six times higher flow rate to substantially reduce refrigerant recovery and evacuation time
- Maintains compatibility with ¼" flare standard refrigeration hose connections
- Has lower leak rates than the traditional refrigerant valve/access fittings
- Requires a special tool (FasTest - SCFT20A) to replace the valve core without reclaiming, evacuating and recharging the system. The tool can be purchased directly from FasTest or check with your local supply house.

For additional information, please contact our technical service department.

Functional Troubleshooting

CXM	DXM2	Fault	Htg	Clg	Possible Cause	Solution
Y	Y	**Green Status LED Off**	X	X	Main power problems	Check line voltage circuit breaker and disconnect.
						Check for line voltage between L1 and L2 on the contactor.
						Check for 24VAC between R and C on CXM/DXM'
						Check primary/secondary voltage on transformer.
Y	Y	**HP Fault Code 2** **High Pressure**		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
						Check water flow adjust to proper flow rate.
				X	Water Temperature out of range in cooling	Bring water temp within design parameters.
			X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
						Check fan motor operation and airflow restrictions.
						Dirty Air Coil- construction dust etc.
						Too high of external static. Check static vs blower table.
			X		Air temperature out of range in heating	Bring return air temp within design parameters.
			X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
			X	X	Bad HP Switch	Check switch continuity and operation. Replace.
			X	X	Open water pressure switch (MWV Option)	Reset at 240 PSI, check water pressure. Replace.
Y	Y	**LP/LOC Fault Code 3** **Low Pressure / Loss of Charge**	X	X	Insufficient charge	Check for refrigerant leaks
			X		Compressor pump down at start-up	Check charge and start-up water flow.
Y	Y	**LT1 Fault Code 4** **Water coil low temperature limit**	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
						Plugged strainer or filter. Clean or replace..
						Check water flow adjust to proper flow rate.
			X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
			X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
			X		Water Temperature out of range	Bring water temp within design parameters.
			X	X	Bad thermistor	Check temp and impedance correlation per chart
Y	Y	**LT2 Fault Code 5** **Air coil low temperature limit**		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace.
						Check fan motor operation and airflow restrictions.
						Too high of external static. Check static vs blower table.
				X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
				X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
			X	X	Bad thermistor	Check temp and impedance correlation per chart.
Y	Y	**Condensate Fault Code 6**	X	X	Blocked drain (Note)	Check for blockage and clean drain.
			X	X	Improper trap	Check trap dimensions and location ahead of vent.
				X	Poor drainage	Check for piping slope away from unit.
						Check slope of unit toward outlet.
						Poor venting. Check vent location.
				X	Moisture on sensor	Check for moisture shorting to air coil.
			X	X	Plugged air filter	Replace air filter.
			x	X	Restricted Return Air Flow	Find and eliminate restriction. Increase return duct and/or grille size.
Y	Y	**Over/Under Voltage Code 7** **(Auto resetting)**	X	X	Under Voltage	Check power supply and 24VAC voltage before and during operation.
						Check power supply wire size.
						Check compressor starting. Need hard start kit?
						Check 24VAC and unit transformer tap for correct power supply voltage.
			X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
						Check 24VAC and unit transformer tap for correct power supply voltage.
Y	Y	**Unit Performance Sentinel Code 8**	X		Heating Mode LT2>125°F [52°C]	Check for poor air flow or overcharged unit.
				X	Cooling Mode LT1>125°F [52°C] OR LT2< 40ºF [4ºC])	Check for poor water flow, or air flow.
Y	Y	**Swapped Thermistor Code 9**	X	X	LT1 and LT2 swapped	Reverse position of thermistors
N	Y	**ECM Fault - Code 10**	X	X	Blower does not operate	Check blower line voltage
						Check blower low voltage wiring
					Blower operating with incorrect airflow	Wrong unit size selection
						Wrong unit family selection
						Wrong motor size
						Incorrect blower selection
N	Y	**Low Air Coil Pressure Fault (ClimaDry) Code 11**		X	Reduced or no air flow in cooling or ClimaDry	Check for dirty air filter and clean or replace
						Check fan motor operation and airflow restrictions
						Too high of external static - check static vs blower table
					Air temperature out of range	Too much cold vent air - bring entering air temp within design parameters
					Bad pressure switch	Check switch continuity and operation - replace
N	Y	**Low Air Coil Temperature Fault - (ClimaDry) Code 12**		X	Reduced airflow in cooling, ClimaDry, or constant fan	Check for dirty air filter and clean or replace
						Check fan motor operation and airflow restrictions
						Too high of external static - check static vs blower table
					Air temperature out of range	Too much cold vent air - bring entering air temp within design parameters
					Bad thermistor	Check temp and impedance correlation per chart

Note: TSM has 2 condensate sensors – check cabinet pan and chassis pan for blockage.

Performance Troubleshooting

Performance Troubleshooting	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs. blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible clg. load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or too cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	X	X	Non-condensables in system	Vacuum system and re-weigh in charge.
	X	X	Restricted metering device.	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow in heating.	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Water temperature out of range.	Bring water temperature within design parameters.
		X	Reduced air flow in cooling.	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low Discharge Air Temperature in Heating	X		Too high of air flow	Check fan motor speed selection and air flow chart.
	X		Poor performance	See 'Insufficient Capacity'
High humidity		X	Too high of air flow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible clg load and heat pump capacity.
Modulating Valve Troubleshooting	X	X	Improper output setting	Verify the AO-2 jumper is in the 0-10V position
			No valve output signal	Check DC voltage between AO2 and GND. Should be O when valve is off and between 3.3v and 10v when valve is on.
			No valve operation	Check voltage to the valve
				Replace valve if voltage and control signals are present at the valve and it does not operate

PT ports would not be accessible on high rise units since the chassis and hose are inside the cabinet and unit will not operate properly if opened up.

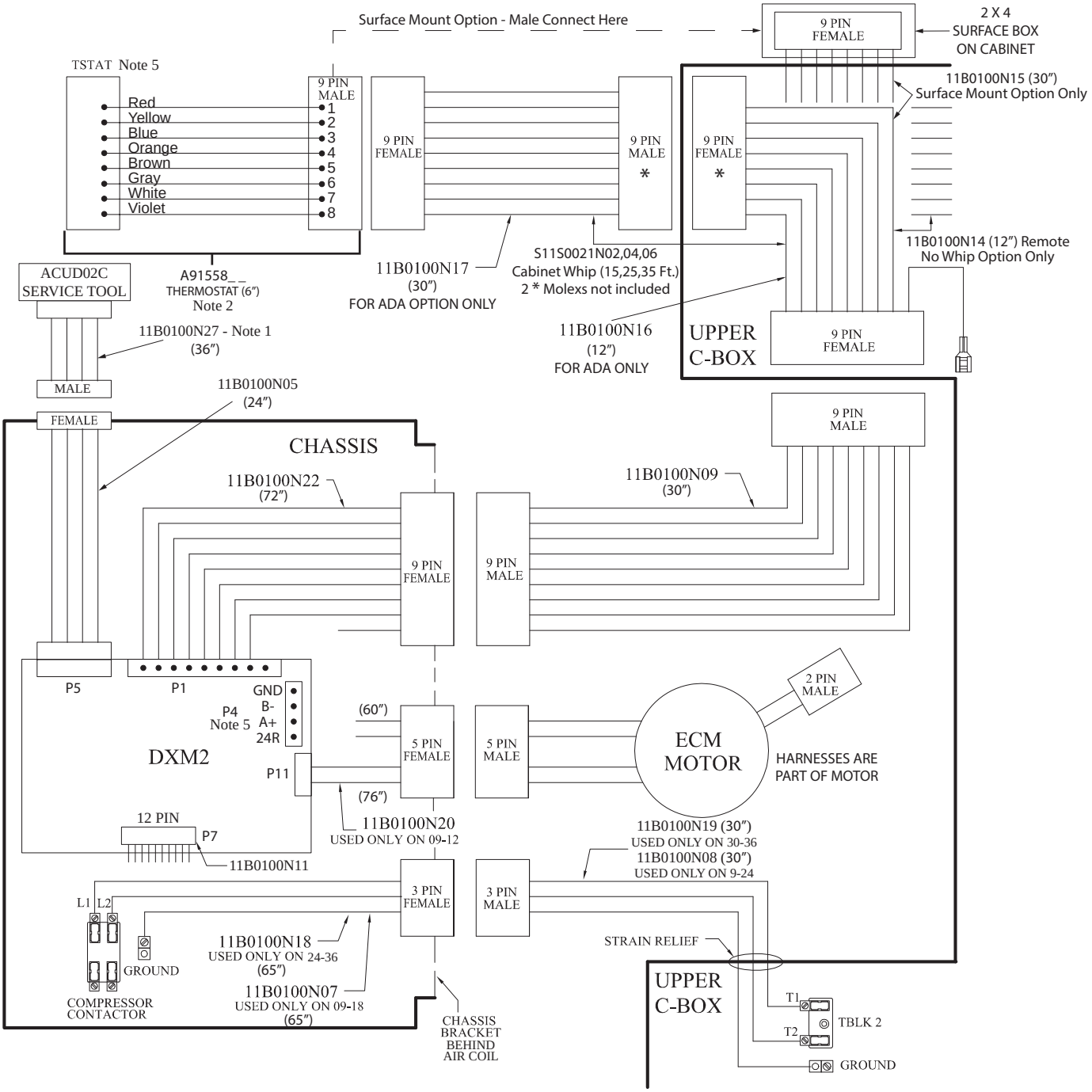
To check temperature - connect thermocouples to chassis supply and return tubes, close up unit, run unit minimum of 15 minutes.

To check water flow through chassis - with unit off, pull chassis part way out, remove hose on chassis return (right side), connect spare hose to chassis return with other end in bucket or vessel to collect the water, open supply shutoff, time water (longer times will be more accurate) and then shutoff, measure water and calculate GPM, reconnect cabinet hose and reassemble chassis.

TSM Vertical Stack

Rev.:08/26/15

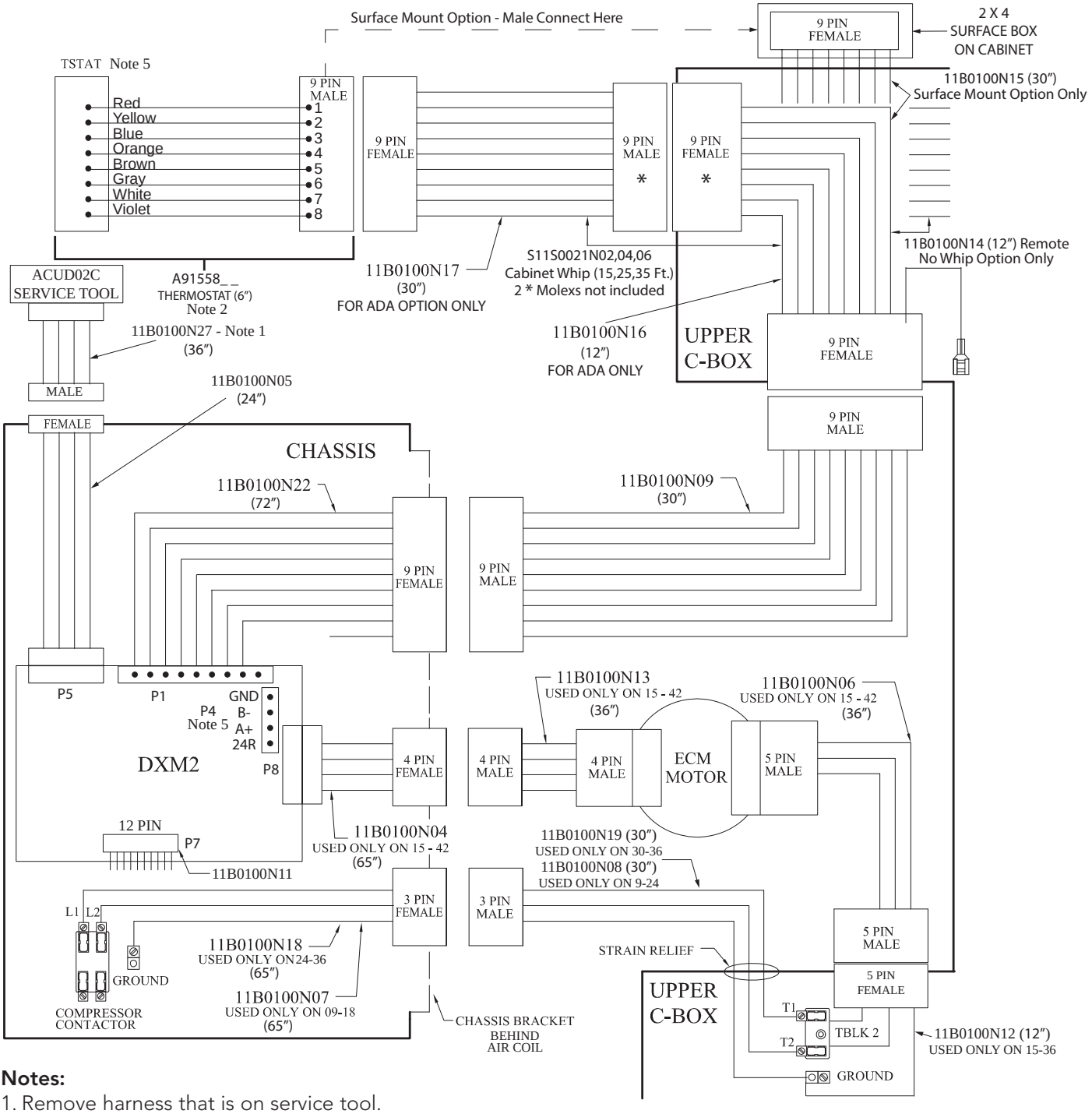
Wire Harnesses for TSM09 - 12 ECM Motor Use for Wire Harness Part Numbers Only



Notes:

1. Remove harness that is on service tool.
2. A9158 - Thermostat connect to ADA Panel, Remote cabinet whip, or Surface box on cabinet. Number of wires will vary.
3. For MPC or LON use 11B0100N24 (in cabinet 12") and 11B0100N25 (in chassis 72")
4. Use unit wire diagram for wire colors and connection points.
5. For ATC32U02 or A9155806 and chassis does not have communicating stat option, must move 4 wires at DXM2 P1 to P4 (BRN to GND, WHT to A+, VIO to B-, Red to R). Remaining wires at P1 remove and tape off.

Wire Harnesses for TSM15 - 36 ECM Motor Use for Wire Harness Part Numbers Only



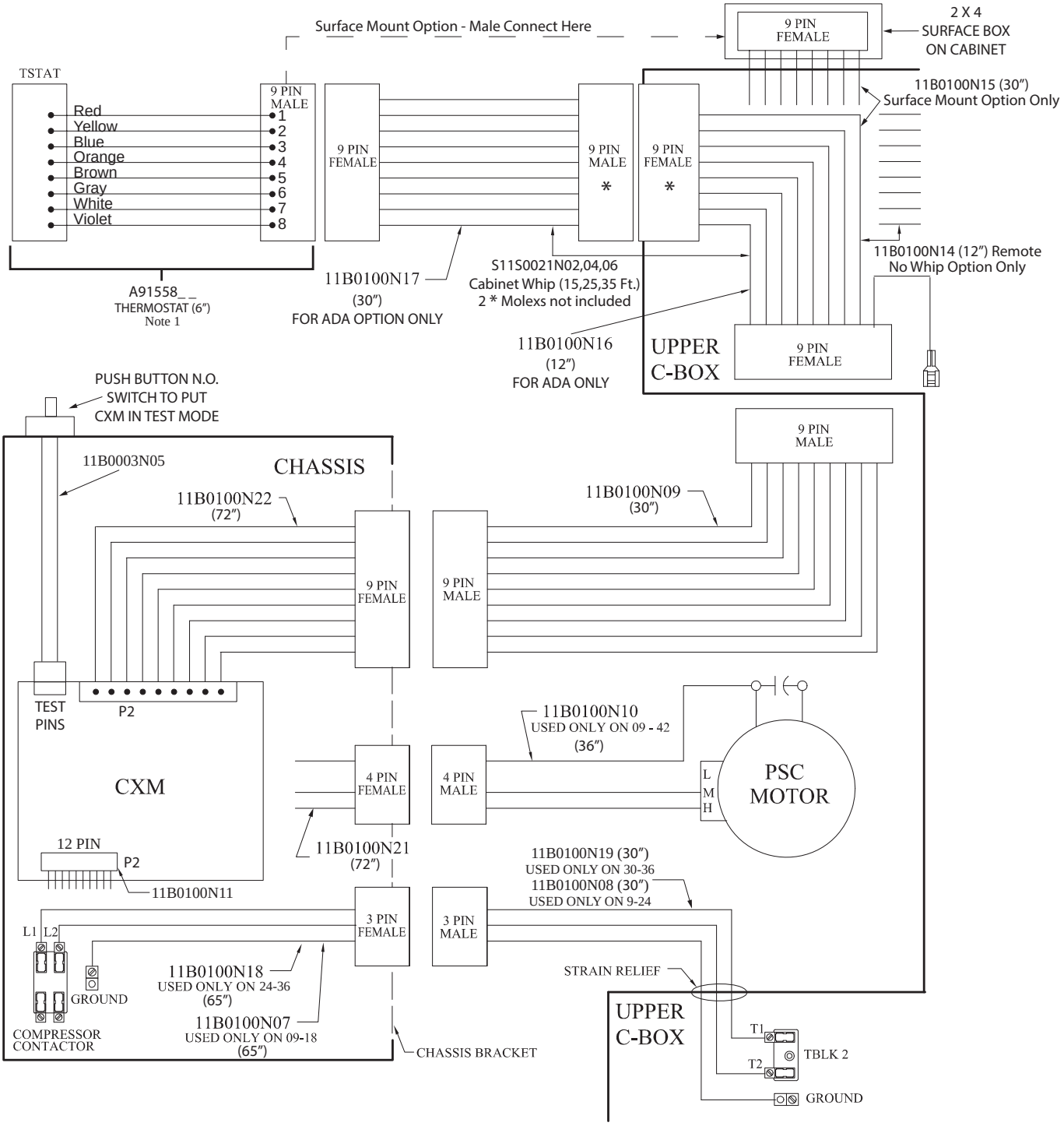
Notes:

1. Remove harness that is on service tool.
2. A9158 - Thermostat connect to ADA Panel, Remote cabinet whip, or Surface box on cabinet. Number of wires will vary.
3. For MPC or LON use 11B0100N24 (in cabinet 12") and 11B0100N25 (in chassis 72")
4. Use unit wire diagram for wire colors and connection points.
5. For ATC32U02 or A9155806 and chassis does not have communicating stat option, must move 4 wires at DXM2 P1 to P4 (BRN to GND, WHT to A+, VIO to B-, Red to R). Remaining wires at P1 remove and tape off.

TSM Vertical Stack

Rev.:08/26/15

Wire Harnesses for TSM09 - 36 PSC Motor Use for Wire Harness Part Numbers Only



Notes:

1. A9158 - Thermostat connect to ADA Panel, Remote cabinet whip, or Surface box on cabinet. Number of wires will vary.
2. For MPC or LON use 11B0100N24 (in cabinet 12") and 11B0100N25 (in chassis 72")
3. Use unit wire diagram for wire colors and connection points.

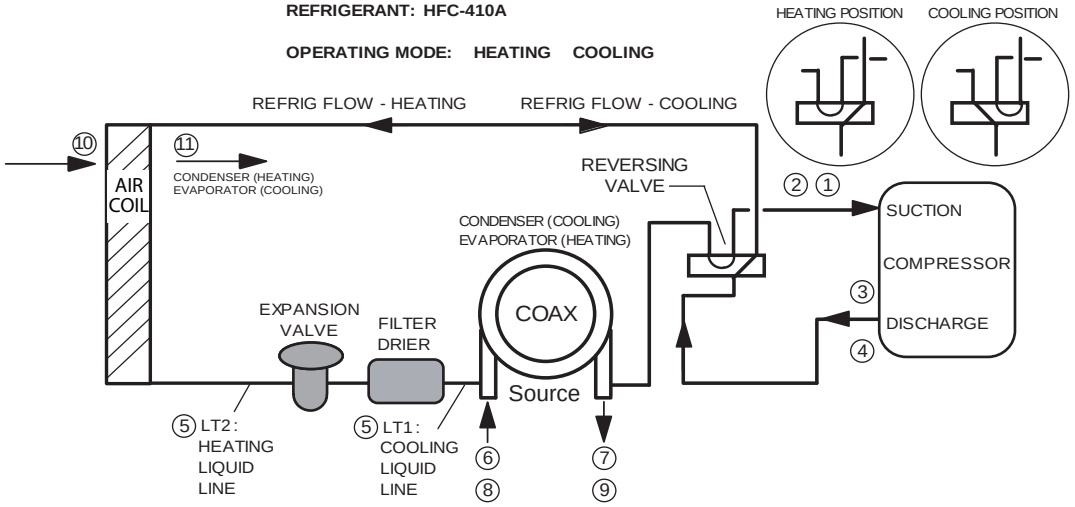
Troubleshooting Form

Water-to-Air Units

Customer: _____ Loop Type: _____ Startup Date: _____

Model #: _____ Serial #: _____ Antifreeze Type & %: _____

Complaint: _____



Description	Heating	Cooling	Notes
Voltage			
Compressor Amps			
1 Suction Temp			
2 Suction Press			
2a Saturation Temp			
2b Superheat			
3 Discharge Temp			
4 Discharge Press			
4a Saturation Temp			
4b Subcooling			
5 Liquid Line Temp			
6 Source Water In Tmp			
7 Source Water Out Tmp			Temp Diff. =
8 Source Water In Pres			
9 Source Water Out Pres			
9a Press Drop			
9b Flow Rate			
10 Return Air Temp			
11 Supply Air Temp			

DXM2 - 3, 6, 7, and 10 can be read by service tool.

Heat of Extraction (Absorption) or Heat of Rejection:

HE or HR =

Fluid Factor: (for Btuh)	Fluid Factor: (for kW)
500 (Water); 485 (Antifreeze)	4.18 (Water); 4.05 (Antifreeze)

_____ Flow Rate x _____ Temp. Diff x _____ Fluid Factor

Superheat = Suction temperature - suction saturation temp. = _____ (deg F)

Subcooling = Discharge saturation temp. - liquid line temp. = _____ (deg F)

Note: Never connect refrigerant gauges during startup procedures. If water-side analysis shows poor performance, refrigerant troubleshooting may be required. Connect refrigerant gauges as a last resort.

ClimateMaster
Geothermal Heat Pump Systems

CLIMATE MASTER, INC.
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CM warrants CM products purchased and retained in the United States of America and Canada to be free from defects in material and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating and/or heat pump units built or sold by CM for twelve (12) months from date of unit start up or eighteen (18) months from date of shipment (from factory), whichever comes first; (2) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from factory). All parts must be returned to CM's factory in Oklahoma City, Oklahoma, freight prepaid, no later than sixty (60) days after the date of the failure of the part; if CM determines the part to be defective and within CM's Limited Express Warranty, CM shall, when such part has been either replaced or repaired, return such to a factory recognized dealer, contractor or service organization, F.O.B. CM's factory, Oklahoma City, Oklahoma, freight prepaid. The warranty on any parts repaired or replaced under warranty expires at the end of the original warranty period.

This warranty does not cover and does not apply to: (1) Air filters, fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) Any portion or component of any system that is not supplied by CM, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment to CM is or has been in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or are caused by accident, misuse or abuse, fire, flood, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures, or unauthorized opening of refrigerant circuit; (8) Mold, fungus or bacteria damages; (9) Products subjected to corrosion or abrasion; (10) Products manufactured or supplied by others; (11) Products which have been subjected to misuse, negligence or accidents; (12) Products which have been operated in a manner contrary to CM's printed instructions; or (13) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application of CM's products.

CM is not responsible for: (1) The costs of any fluids, refrigerant or other system components, or associated labor to repair or replace the same, which is incurred as a result of a defective part covered by CM's Limited Express Warranty; (2) The costs of labor, refrigerant, materials or service incurred in removal of the defective part, or in obtaining and replacing the new or repaired part; or, (3) Transportation costs of the defective part from the installation site to CM or of the return of any part not covered by CM's Limited Express Warranty.

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In the event of a breach of the Limited Express Warranty, CM will only be obligated at CM's option to repair the failed part or unit or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma of each defect, malfunction or other failure and a reasonable number of attempts by CM to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. **THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER OR THEIR PURCHASER AGAINST CM FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY.**

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OBTAINING WARRANTY PERFORMANCE
Normally, the contractor or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CM recognized dealer, contractor or service organization. If assistance is required in obtaining warranty performance, write or call:

Climate Master, Inc. • Customer Service • 7300 S.W. 44th Street • Oklahoma City, Oklahoma 73179 (405) 745-6000

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Please refer to the CM Installation, Operation and Maintenance Manual for operating and maintenance instructions.

Rev.: 11/09

LC083

Notes

Notes

Notes

TSM Vertical Stack

Rev.:08/26/15

Revision History

Date:	Item:	Action:
08/26/15	Removed vFlow, Electrical Heat, Revised Electrical Data	Updated
06/24/15	Misc. edits, updated decoders, elec. HT, vFlow, electrical data	Updated
02/25/15	Misc. edits	Updated
12/18/14	Text - Page 56-57	Updated
12/16/14	Misc. edits	Updated
10/31/14	Misc. edits	Updated
09/03/14	Figure 12 - Page 29	Updated
05/12/14	Page 4, 6, 23, 26, 34	Updated
05/02/14	Page 17 & 25	Updated
03/27/14	Illustration - Page 15	Updated
03/06/14	Text and diagrams	Updated
01/07/14	Table, text, diagrams	Updated
10/08/13	Table 10	Updated
07/01/13	Created	

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